

1.1 EMPLOYMENT IS FREELY CHOSEN

- 1.1.1 There is no forced, bonded or involuntary prison labour.
- 1.1.2 Workers are not required to lodge "deposits" or their identity papers with their employer and are free to leave their employer after reasonable notice.

1.2 Not used

1.3 WORKING CONDITIONS ARE SAFE AND HYGIENIC

- 1.3.1 A safe and hygienic working environment shall be provided, bearing in mind the prevailing knowledge of the industry and of any specific hazards. Adequate steps shall be taken to prevent accidents and injury to health arising out of, associated with, or occurring in the course of work, by minimising, so far as is reasonably practicable, the causes of hazards inherent in the working environment.
- 1.3.2 Workers shall receive regular and recorded health and safety training, and such training shall be repeated for new or reassigned workers.
- 1.3.3 Access to clean toilet facilities and to potable water, and, if appropriate, sanitary facilities for food storage shall be provided.
- 1.3.4 Accommodation, where provided, shall be clean, safe, and meet the basic needs of the workers.
- 1.3.5 The company observing the code shall assign responsibility for health and safety to a senior management representative.

1.4 CHILD LABOUR SHALL NOT BE USED

- 1.4.1 There shall be no recruitment of child labour.
- 1.4.2 Companies shall develop or participate in and contribute to policies and programmes which provide for the transition of any child found to be performing child labour to enable her or him to attend and remain in quality education until no longer a child.
- 1.4.3 Children and young persons under 18 shall not be employed at night or in hazardous conditions.
- 1.4.4 These policies and procedures shall conform to the provisions of the relevant ILO standards.

1.5 LIVING WAGES ARE PAID

- 1.5.1 Wages and benefits paid for a standard working week meet, at a minimum, national legal standards or industry benchmark standards, whichever is higher. In any event wages should always be enough to meet basic needs and to provide some discretionary income.
- 1.5.2 All workers shall be provided with written and understandable Information about their employment conditions in respect to wages before they enter employment and about the particulars of their wages for the pay period concerned each time that they are paid.
- 1.5.3 Deductions from wages as a disciplinary measure shall not be permitted nor shall any deductions from wages not provided for by national law be permitted without the expressed permission of the worker concerned. All disciplinary measures should be recorded.

1.6 WORKING HOURS ARE NOT EXCESSIVE

- 1.6.1 Working hours comply with at least UK national laws and benchmark industry standards, whichever affords greater protection.
- 1.6.2 Not used.

1.7 NO DISCRIMINATION IS PRACTISED

- 1.7.1 There is no discrimination in hiring, compensation, access to training, promotion, termination or retirement based on race, caste, national origin, religion, age, disability, gender, marital status, sexual orientation, union membership or political affiliation.

1.8 REGULAR EMPLOYMENT IS PROVIDED

- 1.8.1 To every extent possible work performed must be on the basis of recognised employment relationship established through national law and practice.
 - 1.8.2 Obligations to employees under labour or social security laws and regulations arising from the regular employment relationship shall not be avoided through the use of labour-only contracting, sub- contracting, or home-working arrangements, or through apprenticeship schemes where there is no real intent to impart skills or provide regular employment, nor shall any such obligations be avoided through the excessive use of fixed-term contracts of employment.
- 1.9 NO HARSH OR INHUMANE TREATMENT IS ALLOWED**
- 1.9.1 Physical abuse or discipline, the threat of physical abuse, sexual or other harassment and verbal abuse or other forms of intimidation shall be prohibited.

SECONDARY OPTION CLAUSES - For Information

Option X1: Price adjustment for inflation

If *staff rates* are fixed at the Contract Date and are not variable with changes in salary paid to individuals.

Price adjustment factor

X1

X1.1 On each anniversary of the Contract Date, the *Consultant* calculates a price adjustment factor equal to $(L - B)/B$, where L is the last published value of the *index* and B is the last value of the *index* published before the Contract Date.

If an *index* is changed after it has been used in calculating a price adjustment factor, the calculation is repeated and a correction included in the next assessment of the amount due.

The price adjustment factor calculated at the Completion Date for the whole of the *services* is used for calculating price adjustment after this date.

Price adjustment

X1.2 Each amount due after the first anniversary includes an amount for price adjustment which is the sum of

- the change in the Price for Services Provided to Date since the last assessment of the amount due multiplied by the price adjustment factor calculated at the last anniversary and
- the amount for price adjustment included in the previous amount due.

Price adjustment Option C

X1.3 Each time the amount due is assessed after the first anniversary, an amount for price adjustment is added to the total of the Prices which is the change in the Price for Services Provided to Date since the last assessment of the amount due multiplied by $(PAF/(1+PAF))$ where PAF is the price adjustment factor calculated at the last anniversary.

Expenses adjustment

X1.6 If payment rates for any of the *expenses* are fixed at the Contract Date and are not otherwise adjustable for inflation, each amount due after the first anniversary includes an amount for *expenses* adjustment which is the sum of

- the change in fixed *expenses* since the last assessment of the amount due multiplied by the price adjustment factor calculated at the last anniversary and
- the amount for *expenses* adjustment included in the previous amount due.

If *staff rates* are variable with changes in salary paid to individuals.

Price adjustment factor

X1

X1.1 On each anniversary of the Contract Date, the *Consultant* calculates a price adjustment factor equal to $(L - B)/B$, where L is the last published value of the index and B is the last value of the index published before the Contract Date.

If an index is changed after it has been used in calculating a price adjustment factor, the calculation is

		repeated and a correction included in the next assessment of the amount due.
		The price adjustment factor calculated at the Completion Date for the whole of the <i>services</i> is used for calculating price adjustment after this date.
Price adjustment Option A	X1.2	Each amount due after the first anniversary includes an amount for price adjustment which is the sum of the change in the Price for Services Provided to Date since the last assessment of the amount due multiplied by the price adjustment factor calculated at the last anniversary and the amount for price adjustment included in the previous amount due.
Price adjustment Option C	X1.3	Each time the amount due is assessed after the first anniversary, an amount for price adjustment is added to the total of the Prices which is the change in the Price for Services Provided to Date since the last assessment of the amount due multiplied by $(PAF/(1+PAF))$ where PAF is the price adjustment factor calculated at the last anniversary.
Price adjustment Option G	X1.4	Each amount due after the first anniversary includes an amount for price adjustment which is the sum of <ul style="list-style-type: none"> • for the lump sum items on the Task Schedule, the change in the lump sums included in the Price for Services Provided to Date since the last assessment of the amount due multiplied by the price adjustment factor calculated at the last anniversary before the assessment and • the amount for price adjustment included in the previous amount due.
Compensation events Options A, C and G (lump sum items on the Task Schedule) only	X1.5	The Time Charge for compensation events is assessed using the <i>staff rates</i> current at the time of assessing the compensation event adjusted to the Contract Date by dividing by $(1+PAF)$, where PAF is the price adjustment factor calculated at the last anniversary.
Expenses adjustment	X1.6	If payment rates for any of the <i>expenses</i> are fixed at the Contract Date and are not otherwise adjustable for inflation, each amount due after the first anniversary includes an amount for <i>expenses</i> adjustment which is the sum of <ul style="list-style-type: none"> • the change in fixed <i>expenses</i> since the last assessment of the amount due multiplied by the price adjustment factor calculated at the last anniversary and • the amount for <i>expenses</i> adjustment included in the previous amount due.

Option X2: Changes in the law

Changes in the law

X2

X2.1 A change in the *law of the project* (and which is not a change in law which a competent and experienced consultant familiar with works

similar to the *services* and exercising the foresight appropriate to such a consultant ought, or ought reasonably to have, anticipated at the Contract Date) is a compensation event if it occurs after the Contract Date. Either Party may notify the other of a compensation event for such a change in law. If the effect of a compensation event which is such a change in law is to reduce the total Time Charge, the Prices are reduced.

Option X3: Multiple currencies (used only with Options A and G)

Multiple currencies

X3

- X3.1 The *Consultant* is paid in currencies other than the *currency of this contract* for the items or activities listed in the Contract Data. The *exchange rates* are used to convert from the *currency of this contract* to other currencies.
- X3.2 Payments to the *Consultant* in currencies other than the *currency of this contract* do not exceed the maximum amounts stated in the Contract Data. Any excess is paid in the *currency of this contract*.

Option X4: Parent company guarantee

Parent company guarantee

X4

- X4.1 If a parent company owns the *Consultant*, the *Consultant* gives to the *Employer* a guarantee by the *Consultant's* parent company of the *Consultant's* performance and, if requested by the *Employer*, a legal opinion as to the enforceability of the guarantee in the form attached at Schedule 4B of the Framework Agreement. If the guarantee (and the legal opinion, if applicable) was not given by the Contract Date, it is given to the *Employer* within one week of the Contract Date.

Option X5: Sectional Completion (not used with Option G)

Sectional Completion

X5

- X5.1 In these *conditions of contract*, unless stated as the whole of the *services*, each reference and clause relevant to
- the *services*,
 - Completion and
 - Completion Date
- applies, as the case may be, to either the whole of the *services* or any *section* of the *services*.

Option X6: Bonus for early Completion (not used with Option G)

Bonus for early Completion X6

X6.1 The *Consultant* is paid a bonus calculated at the rate stated in the Contract Data for each day from Completion until the Completion Date.

Option X7: Delay damages

Delay damages X7

Options A, C and E

X7.1 The *Consultant* pays delay damages at the rate stated in the Contract Data for each day from the Completion Date until Completion.

X7.2 If the Completion Date is changed to a later date after delay damages have been paid, the *Employer* repays the overpayment of damages with interest. Interest is assessed from the date of payment to the date of repayment and the date of repayment is an assessment date.

Option X8: Collateral warranty agreements

Collateral warranty agreements X8

X8.1 The *Consultant* enters into the *collateral warranty agreements*.

Option X9: Transfer of rights

Transfer of rights X9

X9.1 The *Employer* owns the *Consultant's* rights over material prepared for this contract by the *Consultant* except as stated otherwise in the Scope. The *Consultant* obtains other rights for the *Employer* as stated in the Scope and obtains from a Subconsultant equivalent rights for the *Employer* over the material prepared by the Subconsultant. The *Consultant* provides to the *Employer* the documents which transfer these rights to the *Employer*.

Option X10: Employer's Agent

Employer's Agent X10

X10.1 The *Employer's Agent* acts on behalf of the *Employer* with the authority set out in this Option X10 or as otherwise stated in the Contract Data.

X10.2 Except to the extent that the *Employer* may otherwise specify by written notice to the *Consultant* or as otherwise stated in the Contract Data, the *Employer's Agent* has full authority to receive and issue applications, certificates, consents, instructions, notices, requests or statements and otherwise to act for the *Employer* under

any of the *conditions of contract*. All instructions from the *Employer's Agent* are in writing and signed by the *Employer's Agent*. For the avoidance of doubt the *Employer's Agent* does not have the authority to vary the *conditions of contract*.

X10.3 The *Employer* may replace the *Employer's Agent* after he has notified the *Consultant* of the name of the replacement.

Option X11: Termination by the *Employer*

Termination by the *Employer*

X11

X11.1 The *Employer* may terminate the *Consultant's* obligation to Provide the Services for a reason not stated in this contract by notifying the *Consultant*.

X11.2 If the *Employer* terminates for a reason not stated in this contract, an additional amount is due on termination which is 5% of the difference between

- the forecast of the final total of the Prices in the absence of termination and
- the total of the other amounts and costs included in the amount due on termination.

Option X12: Partnering

Identified and defined

X12

terms

X12.1 (1) The Partners are those named in the Schedule of Partners. The *Client* is a Partner.

(2) An Own Contract is a contract between two Partners which includes this Option.

(3) The Core Group comprises the Partners listed in the Schedule of Core Group Members.

(4) Partnering Information is information which specifies how the Partners work together and is either in the documents which the Contract Data states it is in or in an instruction given in accordance with this contract.

(5) A Key Performance Indicator is an aspect of performance for which a target is stated in the Schedule of Partners.

Actions

X12.2 (1) Each Partner works with other Partners to achieve the *Client's objective* stated in the Contract Data and the objectives of every other Partner stated in the Schedule of Partners.

(2) Each Partner nominates a representative to act for him in dealings with other Partners.

(3) The Core Group acts and takes decisions on behalf of the Partners on those matters stated in the Partnering Information.

(4) The Partners select the members of the Core Group. The Core Group decides how they will work and decides the dates when each member joins and leaves the Core Group. The *Client's* representative leads the Core Group unless stated otherwise in the Partnering Information.

(5) The Core Group keeps the Schedule of Core Group Members and the Schedule of Partners up to date and issues copies of them to the Partners each time either is revised.

(6) This Option does not create a legal partnership between Partners who are not one of the Parties in this contract.

Working together

X12.3 (1) The Partners work together as stated in the Partnering Information and in a spirit of mutual trust and co-operation.

(2) A Partner may ask another Partner to provide information which he needs to carry out the work in his Own Contract and the other Partner provides it.

(3) Each Partner gives an early warning to the other Partners when he becomes aware of any matter that could affect the achievement of another Partner's objectives stated in the Schedule of Partners.

(4) The Partners use common information systems as set out in the Partnering Information.

(5) A Partner implements a decision of the Core Group by issuing instructions in accordance with its Own Contracts.

(6) The Core Group may give an instruction to the Partners to change the Partnering Information. Each such change to the Partnering Information is a compensation event which may lead to reduced Prices.

(7) The Core Group prepares and maintains a timetable showing the proposed timing of the contributions of the Partners. The Core Group issues a copy of the timetable to the Partners each time it is revised. The *Consultant* changes his programme if it is necessary to do so in order to comply with the revised timetable. Each such change is a compensation event which may lead to reduced Prices.

(8) A Partner gives advice, information and opinion to the Core Group and to other Partners when asked to do so by the Core Group. This advice, information and opinion relates to work that another Partner is to carry out under its Own Contract and is given fully, openly and objectively. The Partners show contingency and risk allowances in information about costs, prices and timing for future work.

(9) A Partner notifies the Core Group before subcontracting any work.

Incentives

X12.4 (1) A Partner is paid the amount stated in the Schedule of Partners if the target stated for a Key Performance Indicator is improved upon or achieved. Payment of the amount is due when the target has been improved upon or achieved and is made as part of the amount due in the Partner's Own Contract.

(2) The *Client* may add a Key Performance Indicator and associated payment to the Schedule of Partners but may not delete or reduce a payment stated in the Schedule of Partners.

Option X13: Performance bond

Performance bond**X13**

X13.1 The *Consultant* gives the *Employer* a performance bond, provided by a bank or insurer which the *Employer* has accepted, for the amount stated in the Contract Data and in the form set out in Schedule 8 of the Framework Agreement. A reason for not accepting the bank or insurer is that its commercial position is not strong enough to carry the bond. If the bond was not given by the Contract Date, it is given to the *Employer* within one week of the Contract Date.

Option X18: Limitation of liability**Limitation of liability****X18**

X18.1 Without prejudice to the *Employer's* entitlement to delay damages (Option X7) where that option is included in this contract, the *Consultant's* liability to the *Employer* for the *Employer's* indirect or consequential loss is limited to the amount stated in the Contract Data provided that this limitation does not apply to any liability for:

- Losses caused by fraudulent acts or acts of a criminal nature;
- any other Losses against which the *Consultant* is entitled to an indemnity under any policy of insurance up to (but not exceeding) the amount which the *Consultant* is obliged to maintain under this Contract;
- all Losses arising out of any use by the *Employer* of the Background IPR, including, without limitation, any claim that the exploitation of the licence granted by the *Consultant* under clause 109.2 infringes the intellectual property rights or other rights of any third party,
- delay damages if Option X7 applies,
- *Consultant's* share if Option C applies,
- an infringement by the *Consultant* of the rights of Others,
- loss of or damage to third party property, and
- death of or bodily injury to a person other than an employee of the *Consultant*.

X18.2 The *Consultant's* liability to the *Employer* for Defects that are not found until after the *defects date* is not limited and is an addition to any damages stated in this Contract for delay.

Option X20: Key Performance Indicators (not used with Option X12)**Incentives****X20**

X20.1 A Key Performance Indicator is an aspect of performance by the *Consultant* for which a target is stated in the Incentive Schedule. The Incentive Schedule is the *incentive schedule* unless later

changed in accordance with this contract.

X20.2 From the *starting date* until the *defects date*, the *Consultant* reports to the *Employer* his performance against each of the Key Performance Indicators. Reports are provided at the intervals stated in the Contract Data and include the forecast final measurement against each indicator.

X20.3 If the *Consultant's* forecast final measurement against a Key Performance Indicator will not, or may not achieve the target stated in the Incentive Schedule, he submits his proposals for improving performance.

X20.4 The *Consultant* is paid the amount stated in the Incentive Schedule if the target stated for a Key Performance Indicator is improved upon or achieved. Payment of the amount is due when the *Employer* notifies the *Consultant* that the target has been improved upon or achieved.

X20.5 The *Employer* may add a Key Performance Indicator and associated payment to the Incentive Schedule but may not delete or reduce a payment stated in the Incentive Schedule.

Option X21: Single Point Design Responsibility

Single point design responsibility

X21

X21.1 In this Option, "*Employer's Design Information*" means any drawings, proposals, specifications, method statements, designs, plans, schemes or other documents, or concepts prepared or developed by the *Employer* and included in the Scope.

X21.2 The *Consultant* is fully responsible in all respects for the design of the *services* including, without limitation, any *Employer's Design Information* (which, for all purposes of this contract is deemed to be part of the *Consultant's* design).

X21.3 Where there is a mistake, inaccuracy or discrepancy in the *Employer's Design Information*, the *Consultant* informs the *Employer* in writing of his proposed amendment to remove the mistake, inaccuracy or discrepancy. Within two weeks, the *Employer* may consent to the *Consultant's* proposed amendment or comment in writing on such an amendment provided that the *Employer* does not unreasonably withhold his consent to a proposed amendment. The *Consultant* takes account of such comments and resubmits his proposed amendment to the *Employer*. Such process is repeated until the *Employer* accepts the *Consultant's* proposed amendment.

X21.4 The *Consultant* is not entitled to any changes to the Prices, the Completion Dates or Key Dates by reason of anything in this Option

X21. Further, the *Consultant* hereby agrees that any comment or failure to comment by the *Employer* under this Option X21 is not treated as an act of prevention or breach of contract by the *Employer*.

Timber Standards Appendix

Aim of KPI :

Implement the Mayor's Green Procurement Code

Implement the GLA Sustainable Timber Policy

Implement TfL environmental objective: Reduce resource consumption and improve green procurement

<u>Reporting period</u>	-
<u>Date</u>	-
<u>Completed by</u>	-
<u>Title</u>	-

<u>Desired Outcome</u>	<u>Service Performance Indicator</u>	<u>Quantity (KG)</u>	<u>Value (£)</u>	<u>% of good represented</u>	<u>Reporting Frequency</u>	<u>objective</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>
<u>Reduce resource consumption and improve green procurement (TfL Env' KPI)</u>	<u>Timber complies with Sustainable Timber definition and obligations as per Contract.</u>	=	=	=	<u>Quarterly with Annual report.</u>	Increase/maintain % of sustainable timber supplied					
Reduce resource consumption and improve green procurement (TfL Env' KPI)	Timber does NOT comply with Sustainable Timber definition and obligations as per Contract	=	=	=	<u>Quarterly with Annual report.</u>	<u>Reduce amount of Non Sustainable Timber procured</u>					

CLAUSE TO BE INSERTED IF SERVICES PROVIDED TO LONDON UNDERGROUND LIMITED

28A Specific London Underground limited Standards

In this Clause, unless the context indicates otherwise, the following expressions shall have the following meanings:

“Contract QUENSH Conditions”	the Quality Environmental Safety and Health Contract Conditions in force and as supplied to the Consultant by LUL from time to time;
“London Underground”	the stations and depots, assets, systems, track and other buildings which are used in the maintenance and provision of underground services known as “London Underground”;
“LUL”	London Underground Limited;
“LUL Standards”	the mandatory requirements in force on the London Underground from time to time that the Consultant must comply with in the provision of the Services, comprising mandatory category 1 standards, applicable LUL rules, procedures, codes, standards and safety agreements in relation to, without limitation, health and safety, environment, security, operational, engineering and ambience standards and other customer service delivery standards (including, without limitation, the Contract QUENSH Conditions).

Without prejudice to any other provisions of the Contract:

28A.1 The Consultant acknowledges its awareness of the Employer’s statutory duty to provide or secure safe, economic and efficient public passenger transport services by railway for Greater London and shall at all times during this Contract have regard to the Employer’s statutory duties. The Consultant shall not, in the performance of the Services, in any manner endanger the safety of or interfere with the operation of the London Underground or endanger the public and shall minimise any disruption to both the London Underground and the public.

28A.2 The Consultant acknowledges, and undertakes to inform all Consultant’s Personnel who will be using the Employer’s communication facilities that the Employer reserves the right from time to time to:

28.2.1 intercept, for the purposes of monitoring and / or recording, any communication made through any system capable of transmitting communications including but not limited to telephone, electronic mail, facsimile, voicemail or internet facility provided by the Employer; and

28A.2.2 use any information obtained as a result of any intercepted communication referred to in Clause 28A.2.1 for the purposes permitted by the Telecommunications (Lawful Business Practice) (Interception of Communications) Regulations 2000.

28A.3 In providing the Services, the Consultant shall comply with LUL Standards.

28A.4 One of the LUL Standards which may be of relevance to this Contract is QUENSH which governs safety for places of work on or around the operational railway. If applicable, the Consultant shall comply with the Contract QUENSH Conditions as indicated and respond to the menu provided by the Contract Manager.

28A.5 It is the responsibility of the Consultant to ensure that it receives the LUL Standards from LUL for the required Services and must ensure that it has been appraised by LUL as capable of

providing the Services in terms of the LUL Standards. If the Consultant has not been appraised or has not been provided with the Contract QUENSH Conditions, it is the Consultant's obligation to raise this with the Contract Manager and if necessary cease work until the appraisal is completed.

28A.6 Where there is a requirement indicated in the Contract QUENSH Conditions to comply with one or more conditions, it is the responsibility of the Consultant to satisfy itself of the requirements of the indicated conditions as contained in Contract QUENSH Conditions. Access to LUL Standards can be gained through the intranet, of which access can be obtained on request to the Contract Manager.

Schedule 3 - Framework Scope

TfL Professional Services Framework Agreement: Rail Engineering

RAIL ENGINEERING

Introduction

The supplier will need to demonstrate knowledge and understanding of all professional engineering matters relating to Railway Engineering and be able to apply them to the operation of an underground Metro, light rail operations (DLR and Tram operations) and heavy rail operations (both passenger and freight).

The supplier will need to demonstrate knowledge and understanding of station operations and processes in use on stations (e.g. Compliance, standards and strategy), particularly in relation to the operation of an underground Metro. Knowledge of the station access regime, interface issues between trains and stations, issues associated with heating, ventilation, air conditioning and lighting within an underground environment, architectural and design issues is also essential.

The supplier will also need to be able to assist TfL with the analysis of station design, operations, methods of improving safety and security, improving communication systems and networks and the various interaction and interfaces concerning equipment or systems within a station environment.

The supplier will be expected to supply a wide range of advice, studies, surveys, reports, design and supervision services which will in turn rely and depend on skill, competence and capabilities including but not limited to the following capability details:

Sub-categories:

Framework Agreement: Rail Engineering	
(a)	Power
(b)	Premises
(c)	Rolling Stock
(d)	Signalling
(e)	Track
(f)	Railway Engineering
(g)	Command, Control and Telecoms
(h)	Systems Engineering

(a) POWER

The supplier shall demonstrate their knowledge and ability to communicate with and advise their client in the following areas:

1) Power Engineering

- Power SCADA specialism
- AC Power Modelling and Studies (including DNO and National Grid infrastructure assessments)
- DC Power Modelling
- Train Simulation and Multi Train Simulation for Power System Modelling
- Power Quality Studies (including DNO and National Grid infrastructure assessments)
- Power System Reliability Modelling
- Harmonic Profile Modelling (including DNO and National Grid infrastructure assessments)
- AC Protection Studies
- Asset Management deep technical support e.g. review of age profiles and specialist asset condition assessments
- High Voltage specialist technical support e.g. Specialist advice and support on partial discharge monitoring and testing
- Development of HV Power electrical design, including concept and detailed design
- Earthing systems specialist advice and technical support

(b) PREMISES

The supplier shall demonstrate their knowledge and ability to communicate with and advise their client in the following areas:

1) Stations Engineering:

- Platforms and associated furniture
- Station buildings, inc staff facilities & equipment rooms
- Station control rooms
- Station planning guidelines
- Platform train interface
- Fire compliance of materials
- Fire engineering within a metro rail system and compartmentation
- Fire detection and suppression

2) Depot Engineering, Plant and Equipment:

- Depots and non-rolling stock depots
- Fire compliance of materials
- Fire engineering within a metro rail system and compartmentation
- Fire detection and suppression
- Plant & equipment and on-track plant

(c) ROLLING STOCK

The supplier shall demonstrate their knowledge and ability to communicate with and advise their client in the following areas:

1) Rolling Stock Engineering

- Brakes
- Doors
- Car bodies
- Bogies
- Crashworthiness
- Mechanical design
- Electrical design, installation and protection (high / low voltage)
- Auxiliary systems design
- Pneumatic system design
- Structural integrity
- Fire performance of materials
- Propulsion systems
- Train management system design and functionality
- On-train diagnostic systems – e.g. saloon CCTV, incident recorder systems
- Automatic Train Operation (ATO) systems
- Automatic Train Protection systems
- Train performance
- Wheelset design
- Wheel rail interface
- Optimisation of train performance in low adhesion conditions
- Noise, ride & vibration
- Rolling stock maintenance
- Rolling stock testing and commissioning

- Depot equipment (and associated equipment/systems)
- Rolling stock audits and inspections
- Human factors, cab design and driver ergonomics

(d) SIGNALLING

The supplier shall demonstrate their knowledge and ability to communicate with and advise their client in the following areas:

1) Signalling Design Engineering

- Signalling design
- Point operating equipment
- Remote condition monitoring
- Automatic Train Control (ATC) systems, including coded track and Communications Based Train Control Systems that provide Automatic Train Operation (ATO) and Automatic Train Protection (ATP)
- Automatic Train Supervision (ATS) systems and Train Describer systems
- Assurance activities for product and system acceptance
- General technical support

2) Signalling Installation, Testing and Maintenance Engineering

- Signalling installation, testing and commissioning
- Signalling maintenance & repair
- Signalling audit and inspection
- Incident investigation
- Signalling asset management / asset performance
- Point operating equipment
- Remote condition monitoring
- Risk based maintenance
- Assurance activities for product and system acceptance
- General technical support

(e) TRACK

Permanent Way is an asset which varies widely in both age and environment from the deep tube environment through to the sub surface tunnels to open areas. The supplier is required to provide technical and professional advice on the Permanent Way asset and provide pragmatic solutions. The supplier shall also demonstrate their knowledge and ability to communicate with and advise their client in the following areas:

1) Track design

- Track design including running rail and conductor rail design
- Gauging assessment including platform train interface
- Train arrestor design
- Longitudinal timber design
- Track component design
- Standards including specifications

2) Permanent Way Audit and Inspection

- Audit
- Inspection
- Standards including specifications

3) Track Asset Management

- Strategy
- Noise and Vibration
- Wheel Rail Interface
- Standards including specifications

4) Plant and Equipment

- Assessment of track plant for track renewals including on track plant
- Assessment of track plant for maintenance including on track plant
- Approval of track plant including on track plant
- Standards including specifications

(f) RAILWAY ENGINEERING

The supplier shall demonstrate their knowledge and ability to communicate with and advise their client in the following areas:

1) Railway Project Development

The objectives of railway project development are to:

- Work with stakeholders and agree the requirements of the problem to be solved.
- Identify possible solutions, their feasibility, benefits, costs and risks.
- Prepare a business case to justify works to implement a solution.

The supplier shall demonstrate competence and capability in the following areas to achieve these objectives;

- Legislation, standards and TfL Pathway
- Lifecycle processes and project controls
- Requirements elicitation, negotiation, specification, and documentation
- Concept formulation, working with stakeholder to explore options, establish success criteria, agreement of risks and consensus around concept
- Railway business cases creation in accord with the TfL Business Case Development Manual and WebTag

2) Logistics and Possession Management

The supplier will provide technical and professional advice for the capability which also requires experience in the following specialist areas:

- demand planning and scheduling,
- supply receiving and storing,
- stock picking and distribution,
- returns management,
- negotiating of work sites and
- planning and negotiation of track access and optimizing programme of works.

3) Incident Investigation

Incident Investigation involves accident investigation including accident assessment, repair assessment and brake investigations on assignments such as depot derailments and collision damage.

The supplier shall demonstrate:

- Usage of specialist tools and techniques required by TfL during accident investigations
- Their experience in leading an investigation, engaging with TfL specialists as required
- Their ability to communicate and advise on technical aspects of most railway systems and investigation analysis of simulated or actual accident scenarios that involve railway systems
- Their knowledge and experience in the understanding of accident mechanisms, their immediate causes, causal factors and root causes
- Their competence in applying investigative techniques including root cause analysis
- Their ability to preserve and manage evidence captured in a controlled manner
- Their knowledge and experience in assessment of damage to assets
- Their knowledge and experience in assessment of remedial works necessary to recover damaged assets and bring them back to full service operation
- Usage of specialist tools and techniques to be able to be an expert witness
- The ability to present their findings and conclusions, in terms of immediate causes, causal factors and root causes, in clear, logical structured report with recommendations that appropriately address the root causes identified.

4) Railway Assurance

The supplier shall demonstrate:

- A full working knowledge of Railway and other Guided Transport Systems (Safety) Regulations 2006 (as amended) and other statutory obligations, regulatory guidance, the London Rail & Underground Safety Management Systems, applicable European / British Standards, building regulations and appropriate industry standards and their ability to directly support the client in their application
- Compliance with TfL and LUL standards including the ability to meet safety requirements
- Their knowledge and ability to act as an Independent Safety Assessor (ISA) and Vehicle Acceptance Body (VAB) or Notified Body (NoBo).

(g) COMMAND, CONTROL AND TELECOMS

1) Railway control system engineering

Railway Control Systems include signalling control, customer information systems, and station, line and network control systems.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details.

The supplier shall demonstrate competence in:

- Railway control system requirements
- Railway control system design including
 - Functional analysis and design,
 - Operations planning and scheduling,
 - Timetabling and ticketing systems,
 - Timetabling development and testing,
 - Station, terminal and crew management,
 - Operational rules and standards,
 - Emergency planning.
 - Design integration, testing and commissioning of signal control, telephony, data, ERP, SCADA, CCTV and PA networks.
- Railway control system testing.
- Railway control system documentation
- TfL railway domain knowledge

Knowledge and understanding of the assets, processes and roles that are used in the railway environments of London Underground, the Docklands Light Railway, London Overground and Croydon Tramlink and those areas of these railways that interface with, adjoin or are in close proximity to Network Rail.

2) Information Security engineering

Information security engineering is a set of risk-based technical and procedural controls to minimise vulnerabilities of engineering systems to electronic (or cyber) threats throughout the asset lifecycle. In the TfL Railway Environments, particular systems are critical to the safe and reliable operation of the railway, such a signalling systems, power SCADA, PA, and CCTV systems.

The supplier will be expected to supply advice, studies, test procedures, analysis, reports, design and supervision services which will, in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:

The supplier shall demonstrate competence in:

- The use of information security competence frameworks
- Information security legislation and standards
- Information security documentation

- Auditing of compliance with security objectives, policies, standards and processes.
- Managing cryptographic systems to provide governance and control of electronic security.
- Advising on management of security and information risk consistent with HMG IA policy, standards and guidance.
- Information security design and implementation
- TfL Railway Environment domain Knowledge

Knowledge and understanding of the assets, processes and roles that are used in the railway environments of London Underground, the Docklands Light Railway, London Overground and Croydon Tramlink.

3) SCADA

SCADA is an acronym for Supervisory Control and Data Acquisition. SCADA systems are used to monitor and control plant or equipment in many applications such as telecommunications, electrical power control and railway transportation.

The supplier will be expected to supply advice, studies, test procedures, analysis, reports, design and supervision services which will, in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:

The supplier shall demonstrate competence in:

- SCADA requirements including legislation and standards, operational and maintenance requirements
- Design, development and implementation of SCADA architectures; distributed, networked, cloud-based
 - Telecoms networks – LAN's / WAN's, fibre-based transmission, wireless
 - PLC's/ RTU's design applications in SCADA type plant/ environments
 - PLC/ RTU programming / ladder logic/ IEC 61131-3
 - SCADA protocols – Modbus-TCP, Ethernet, TCP/IP, DNP3, IEEE 60870-5
 - SCADA standards - IEEE 60870, IEEE C37.1-2007
- SCADA testing and commissioning
- Preparing SCADA documentation
- TfL Transport Networks including TfL Railway Environment domain Knowledge

Knowledge and understanding of the SCADA systems, other assets, processes and roles that are used in the railway environments of London Underground, the Docklands Light Railway, London Overground and Croydon Tramlink.

4) Communications Engineering

Communication systems are deployed throughout TfL's transport networks to enable and support operations, maintenance and support services in wide range of geographic locations. Support is provided locally and at line and network control centers. These systems provide key interfaces and functions to TfL's staff, customers and third parties. They facilitate normal, degraded and emergency mode of service operation but also interface with the emergency services during incidents.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:

The supplier shall demonstrate competence in:

- Telecoms networks requirements including legislation, standards, operational and maintenance requirements.
 - R&TTE regulations 2000
 - EMC regulations 2006
 - Wireless & Telegraphy Act 2006
 - EMC legislation and principles
 - The regulatory and spectrum management framework
- The design, testing, commissioning maintenance and operation of communication systems including:
 - Analysis and design methods and processes
 - The application of RAM.
- Design, testing, commissioning, maintenance and operation of communications systems assets including:
 - Analogue radio systems
 - Digital trunk Radio- TETRA (ETSI 300 series)
 - Antennas – directional / arrays/ patch antennas/ leaky feeders
 - Smart antennas – MIMO technology
 - CCTV
 - Public address
 - Telephony systems
 - Data networks
 - IP networks
- Preparing communication system documentation
- TfL domain knowledge
- The understanding and application of communications engineering in transport system environments in general and within TfL railway environments in particular.

5) Wireless Communications

Wireless Communications Systems, transfer data between points that are not connected by an electrical conductor, most commonly using electromagnetic energy. A variety of radio based systems are in use on the TfL transport networks from LF (low frequency) for inductively coupled services to Microwave services in the GHz bands. Wireless devices and services may range from asset tags to complex digital trunk radio systems.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details.

The supplier shall demonstrate competence in:

- Wireless communications systems requirements including legislation and standards.
- Wireless communications system design, testing, commissioning, operations and maintenance.
- Wireless communications systems modelling and tools.
- Signalling and rolling stock compatibility.
- Testing and the use of test equipment to undertake investigations or demonstrate compliance.
- Asset management and software configuration of wireless communications systems assets.
- Preparing wireless communications systems documentation.

- TfL wireless communications systems domain knowledge.
- Knowledge and understanding of wireless communications engineering and the assets that are deployed in the various TfL transport networks and the TfL railway environments. This includes TETRA, and also those areas of the LU railway that interfaces with, adjoin to, or are in close proximity of, Network Rail.

6) Closed Circuit Television Systems CCTV

TfL transport networks are major users of CCTV systems. LU alone has over 16000 camera units. These include a range of technologies from legacy analogue systems to new IP-based CCTV systems using Cat5e structured cabling.

CCTV systems provide visual and video information for command, control, security and incident management for transport services.

The supplier shall demonstrate competence in:

- CCTV requirements including standards, legislation and regulations, operational and maintenance requirements.
- **The design of analogue and digital CCTV systems.**
- Installing, configuring, commissioning and operating analogue and digital CCTV systems.
- Design, testing, commissioning and operation of CCTV transmission systems
- Using CCTV calibration / test equipment
- Design, commissioning and testing of OPO CCTV systems for railway operations.
- Preparing documentation for CCTV systems
- TfL Railway Environment domain CCTV knowledge
- The understanding and application of CCTV engineering and the CCTV assets deployed in TfL transport environments and the TfL railway environments in particular.

7) Public Address Systems

Public address systems PA are used in TfL railway stations as a passenger information system and in sub-surface and tube stations also as a voice alarm in emergencies.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details.

The supplier shall demonstrate competence in:

- PA system requirements including legislation and standards.
- PA system design, configuration, commissioning and operation including:
 - PA system equalisation
 - Designing and configuring high-impedance speaker chains
 - Configuring and setting up BSEN 5839-8 PAVA systems
 - PA related Environmental noise issues
 - Class 1 & 2 environmental noise measurements
 - PA system (electrical and acoustic) measurements
 - Fire regulations compliant installation practice
- PA Documentation

- TfL Railway Environment domain PA Knowledge
- Knowledge and understanding of PA systems engineering and the PA assets that are deployed in the railway environments of London Underground, the Docklands Light Railway, London Overground and Croydon Tramlink.

(h) SYSTEMS ENGINEERING

1) Electromagnetic compatibility (EMC)

Electromagnetic compatibility is the understanding, management and control of electromagnetic interference arising from the emission of electromagnetic energy from systems and the impact of that phenomenon on other systems that are susceptible to it. The objective of EMC is to control emissions and susceptibility, so that adverse effects are avoided.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:"

The supplier shall demonstrate competence in:

- EMC requirements
- EMC documentation
- EMC modeling and tools
- Signalling and rolling stock compatibility
- EMC Testing
- Risk based approach to EMC, a risk based and economic approach to the management and control of EMC.
- TfL Railway Environment domain EMC Knowledge

Knowledge and understanding of the EMC characteristics of the assets that are used in the railway environments of London Underground, the Docklands Light Railway, London Overground and Croydon Tramlink and those areas of these railways that interface with, adjoin or are in close proximity to Network Rail.

2) Human Factors (HF)

Human Factors is the understanding of interactions between humans and other elements of a transport system, and the application of theory, principles, data and methods to the design of the transport system in order to optimize human well-being and overall system performance.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:"

The supplier shall demonstrate competence in:

- HF requirements
- HF documentation
- Process change
- Human Factors analysis and design
- Alarm design
- Human Reliability
- TfL Transport including Railway Environment domain knowledge

Knowledge and understanding of the application of Human Factors in transport environments and the TfL railway environments in particular.

3) Systems Engineering

Systems engineering is a technique that aims to manage engineering risk in the design and implementation of projects/programmes of works by considering the problem as a whole rather than disparate parts.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:"

The supplier shall demonstrate competence in:

- Systems engineering standards and reference bodies of knowledge
- Systems engineering documentation
- Lifecycle processes and project controls
- Requirements elicitation, documentation and management,
- Validation and verification
- Design: formulating concepts
- Design: architecture and architecture description
- Configuration management
- TfL transport including railway environment domain knowledge
- Knowledge and understanding of the application of systems engineering in transport environments and the TfL railway environments in particular

4) Simulation and Modelling

Railway system performance engineering aims understand the behaviour of railway performance as a whole and how constituent parts interact. Modelling tool-sets are used to mimic the behaviours of complex real systems. TfL applies this understanding at different stages throughout the lifecycle to allow railway performance to be managed as an emergent property and ensure the railway performs as intended, efficiently and effectively.

The supplier will be expected to supply advice, studies, surveys, reports, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:

The supplier shall demonstrate competence in:

- Systems Performance Engineering Delivery, analysis, modelling & simulation techniques, including the application of the following tools:
 - Train systems models/ simulators, e.g. LU's Railway Engineering Simulator
 - DC traction infrastructure/ power models/ simulators
 - Tunnel Ventilation Modelling (TVM) using the Subway Environment Simulation (SES) software.

- Heat strain risk and ambience benefits appraisals using LUL's Heat Strain Risk Tool (HSRT)
- Computation fluid dynamics models (CFD)
- Railway performance, scheduling and journey time analysis
- DC traction power, ventilation, cooling and refrigeration design analysis
- Simulation and Modelling documentation
- Systems Performance Engineering Tools Development
 - Knowledge of Intel and/or Sun computers, their operating systems and commonly used development systems
 - Object-oriented coding techniques using C++, produce and implement structured, and well-documented code, and software testing plans
 - Development of engineering modelling & simulation tools within Windows and Unix environments
 - Development of data pre-processing and post-processing programs and scripts
- Engineering and System Engineering Knowledge
 - Requirements capture and production of requirement specifications
 - Fluid dynamics, heat transfer and thermodynamics
 - Use of systems engineering tools
 - Dynamic system measurements and testing
 - Mechanical engineering principles
 - Safety legislation and railway operating rules and regulations
 - TfL railway environments domain knowledge
 - Risk management principles

5) High Integrity Software Based Systems

Software systems are increasingly at the core of modern transport networks. TfL undertakes the following roles within the transport network: operator, specifier, intelligent client and overall integrator. In general, TfL prefers not to specify and procure bespoke software, due to the impacts of risk, time and cost. This strategy results in the need to leverage supplier's products where necessary, with adaptation and modification for the particular transport application's environment and needs. Managing the specification, development, test, migration and performance of (supplier) software is often critical to the successful delivery of transport projects and transport systems.

The supplier will be expected to supply advice, studies, reports, analytical, modelling, testing and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:

The supplier shall demonstrate competence in:

- Software system requirements
- Software systems documentation
- Software development and testing
- Software quality and delivery
- Software capability assessments
- TfL Railway Environment domain Knowledge
- Knowledge and understanding of the use of high integrity software in transport environments and the TfL railway environments in particular.

6) Reliability Availability Maintainability (RAM)

TfL's customers and stakeholders expect Transport Systems within London to be reliable and affordable.

- Reliability is the probability that a system will continue to perform correctly to a particular time.
- Availability is the ability of a system to be in a state to perform correctly at any time.
- Maintainability is the probability that a maintenance action can be carried out within a stated time interval. Maintainability also includes the cost of planned maintenance activities required to support safe and reliable operation in service.

The objective of RAM within TfL is to manage the reliability, availability and cost of transport networks so that the performance of these three parameters improves continuously and the adverse effects of any changes are avoided.

The supplier will be expected to supply advice, studies, reports, analytical, modelling, testing and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:

The supplier shall demonstrate competence in:

- RAM requirements
- RAM evidence
- RAM application over the life cycle
- RAM application to software based systems
- Reliability Growth Prediction:
- TfL Railway Environment domain RAM Knowledge

The understanding and application of RAM in transport system environments in general and within TfL railway environments in particular.

7) System Safety Engineering

System safety engineering is the identification, understanding, management and control of safety hazards that originate from incorrect operation or use and that could harm the customers or staff of a transport system.

The objective of System Safety Engineering is to demonstrate that the transport system is free from harm and that safety risks are managed to acceptable levels.

The supplier will be expected to supply advice, studies, surveys, reports, safety cases, design and supervision services which will in turn, rely and depend on skill, competence and capabilities including but not limited to the following capability details:"

The supplier shall demonstrate competence in:

- Safety requirements including legislation and standards
- Safety documentation
- Safety modelling and tools
- Engineering safety management processes
- Safety risk assessment
- Risk control
- Specifying safety targets and related requirements.
- TfL Railway Environment domain safety knowledge
- The understanding and application of system safety engineering in transport environments and the TfL railway environments in particular.

Consultant Grade Definitions

Partner/Director

<p>General</p>	<p>For a partnership, a Partner in the practice; for a limited company, any employee who carries the title “Director” (or “Associate Director” or other similar title) and who is normally chargeable to projects. Member of a company generally in overall charge of the management, policy and conduct of the firm’s business including maintaining effective communication channels and is able to commit the company to undertake all major contracts.</p> <p>Responsible for all grades of personnel.</p>
<p>Typical Education /Qualifications and Experience</p>	<ul style="list-style-type: none"> • Hold appropriate professional qualifications applicable to the discipline commissioned to perform and/or corporate membership of a major institution. • Must have relevant work experience spanning several major programmes. • The ability to demonstrate key involvement in delivering projects of high value and complexity. • Overall responsibility for project(s) and for supervision, control and development of subordinate personnel. • Significant management responsibility and direction within the consultancy including client liaison, specialist skills or experience.
<p>Responsibilities</p>	<ul style="list-style-type: none"> • Develop client relationships. • Review enquiries for consultancy services, prepare fee proposals and negotiate commissions. • Manage and control all the personnel efficiently, and in compliance with all relevant statutory instruments procedures, rules, regulations, standing orders and instructions and the adopted procurement method. • Develop and maintain effective communication channels, between the consultancy and TfL and external consultants and other bodies as necessary. • Ensure that sufficient personnel are assigned for the commission and that they are suitably qualified and motivated to perform the duties allocated to them. • Oversee all commission activities and ensure full adherence. • Comply with all the projects safety and quality assurance procedures and requirements, including audits, and ensure that all consultancy personnel do likewise. • Facilitate and ensure that training needs, both personal and that of the consultancy personnel, are identified and addressed.

Principal Consultant

<p>General</p>	<p>Reporting to Partner / Director. Member of a company who is able to deputise for the Director. The person will have the ability to manage and control teams and ensure that there are sufficient teams of personnel assigned to commissions.</p> <p>Responsible for all grades of consultants and support staff.</p>
<p>Typical Education</p> <p>/Qualifications and Experience</p>	<ul style="list-style-type: none"> • Hold appropriate professional qualifications applicable to the discipline commissioned to perform and/or corporate membership of a major institution. • Must have relevant work experience spanning several programmes. • The ability to demonstrate key involvement in delivering projects of high value and complexity. • Must have substantial transport experience and technical skills appropriate to the discipline. • Responsibility for project(s) and for supervision, control and development of junior personnel. • Significant management responsibility and direction within the Consultancy including client liaison, specialist skills or experience.
<p>Responsibilities</p>	<ul style="list-style-type: none"> • Deputise for the Partner/Director on all aspects of the project. • Manage and control a team(s) of consultants effectively and in compliance with all relevant procedures, rules, regulations, standing orders and instructions and the adopted procurement method. • Communicate effectively with other members of the project team and with other TfL departments and external consultants and bodies where necessary. • Ensure that sufficient personnel are assigned for the commission and that they are suitably qualified and motivated to perform the duties allocated to them. • Supervise, control and develop personnel assigned • Ensure that the team's activities meet the objectives of the commission. • Comply with all the project's safety and quality assurance procedures and requirements and ensure that all team members do likewise. • Ensure that all appropriate training, both personal and that the team personnel, is undertaken.

Senior Consultant

<p>General</p>	<p>Reporting to Partner / Director or Principal Consultant. Person holding corporate membership of a professional body recognised by TfL and has the ability to demonstrate key involvement in delivering projects of high value and complexity.</p> <p>Responsible for all grades of consultants and support staff on behalf of the Director/Partner.</p>
<p>Typical Education /Qualifications and Experience</p>	<ul style="list-style-type: none"> • Hold appropriate professional qualifications applicable to the discipline commissioned to perform and/or corporate membership of a major institution. • Must have relevant work experience spanning several programmes / projects • The ability to demonstrate key involvement in delivering projects of high value and complexity. • Must have substantial transport experience and technical skills appropriate to the discipline. • Responsibility for project(s) and for supervision, control and development of junior personnel. • Significant management responsibility and direction within the organisation including client liaison, specialist skills or experience. •
<p>Responsibilities</p>	<ul style="list-style-type: none"> • Deputise for the Partner/Director or Principal Consultant on all aspects of the Project. • Manage and control a team(s) of consultants effectively and in compliance with all relevant procedures, rules, regulations, standing orders and instructions and the adopted procurement method. • Communicate effectively with other members of the Project Team and with other TfL departments and external consultants and bodies where necessary. • Ensure that sufficient personnel are assigned for the commission and that they are suitably qualified and motivated to perform the duties allocated to them. • Supervise, control and develop personnel assigned • Ensure that the team's activities meet the objectives of the commission. • Comply with all the project's safety and quality assurance procedures and requirements and ensure that all team members do likewise. • Ensure that all appropriate training, both personal and that the team personnel, is undertaken.

Consultant

<p>General</p>	<p>Reporting to Principal Consultant / Senior Consultant. A person with the ability to assist in the management and control of a project team to ensure delivery of the required projects.</p> <p>Responsible for Junior Consultant / administration staff</p>
<p>Typical Education /Qualifications and Experience</p>	<ul style="list-style-type: none"> • Hold appropriate professional qualifications applicable to the discipline commissioned to perform and/or corporate membership of a major institution. • Must have relevant work experience spanning several projects • Must have some transport experience and technical skills appropriate to the discipline. • Responsibility for project(s) and for supervision, control and development of junior personnel.
<p>Responsibilities</p>	<ul style="list-style-type: none"> • Deputise for the Principal Consultant/ Senior Consultant on all aspects of the project. • Assist in the management and control of a project team of consultants to ensure efficiency and compliance with all relevant procedures, rules, regulations, standing orders and instructions and the adopted procurement method. • Communicate effectively with other members of the Project Team and with other TfL departments and external consultants and bodies as necessary. • Supervise, control and develop personnel assigned. • Ensure that own and assigned personnel activities meet the objectives of the commission. • Comply with all safety and quality assurance requirements and ensure that all team personnel to likewise • Ensure that all appropriate training, both personal and that of assigned personnel, is undertaken.

Junior consultant

General	Reporting to Senior Consultant/Consultant. A person with the relevant experience capable of working on some aspects of the delivery of the required project. Responsible for support staff.
Typical Education /Qualifications and Experience	<ul style="list-style-type: none">• Must have relevant work experience in at least one completed project.
Responsibilities	<ul style="list-style-type: none">• Assist the Consultant where appropriate.• Supervise the support staff assigned (if appropriate).• Work in compliance and ensure that all assigned personnel comply with all relevant procedures, rules, regulations, standing orders and instructions and the adopted procurement method.• Ensure that own and assigned personnel's activities meet the objectives of the commission.• Comply with all safety and quality assurance requirements and ensure that all assigned personnel do likewise.• Ensure that all appropriate personal training is undertaken.

Schedule 4A
(Form of Parent Company Guarantee - Framework Agreement)

Form of Parent Company Guarantee - Framework Agreement

(Letterhead of Parent Company)

To: [insert name and address of the Framework Employer]

Date:

Dear Sir/Madam

We, [insert name of Guarantor] ("**the Guarantor**"), understand that you have agreed to enter into a Framework Agreement reference number [] ("**the Framework Agreement**") with [insert name of Consultant] ("**the Consultant**") under which the Consultant has agreed to provide services in accordance with the terms and conditions of the Framework Agreement and call off contracts ("**Call Off Contracts**") issued pursuant to the Framework Agreement on the condition that the obligations of the Consultant under the Framework Agreement and all Call Off Contracts be guaranteed by a Guarantor.

We are [recite the relationship of the Guarantor to the Consultant], and we warrant to you that this description of our relationship with/to the Consultant is true and accurate in all material respects.

WE HEREBY AGREE AND UNDERTAKE with you as follows:-

(a) We unconditionally guarantee to you and to each employer under the relevant Call Off Contract on demand:

- (i) the proper, complete and punctual performance by the Consultant of any and all its obligations, undertakings and responsibilities under the Framework Agreement and any and all Call Off Contracts and we shall forthwith make good any default thereunder on the part of the Consultant;
- (ii) the due and punctual payment by the Consultant of all sums, liabilities, awards, losses, damages, costs, charges and expenses that may be or become due and payable under or arising out of the Framework Agreement and any and all Call Off Contracts in accordance with their terms or otherwise by reason or in consequence of any such default on the part of the Consultant

1.1.1 when and as the same shall become due for performance or payment (as the case may be).

- (b) As a separate and primary obligation we unconditionally guarantee to you and to each employer under the relevant Call Off Contract that in the case of default by the Consultant in making any of the payments or in performing any of the obligations, undertakings and responsibilities set out in paragraph (a) above, we shall on demand pay all sums and observe and perform any or all of such obligations, undertakings and responsibilities as if we instead of the Consultant were the primary obligor. Any payment under this Guarantee shall be made by us in pounds sterling or in any currency which may from time to time replace pounds sterling.
- (c) This Guarantee shall be a continuing security and shall remain in full force and effect until all obligations to be performed or observed by the Consultant under or arising out of the Framework Agreement and any and all Call Off Contracts have been duly and completely performed and observed and the Consultant shall have ceased to be under any actual or contingent liability thereunder.
- (d) Any demand or other notice made under this Guarantee shall be duly made if sent by first class recorded delivery post to us.
- (e) This Guarantee may be enforced without first notifying the Consultant of any default or taking any proceedings or demanding upon, enforcing or exhausting any right or remedy against the Consultant or any other person or taking any action to enforce any other security, bond or guarantee or making or filing any claim in a bankruptcy, liquidation, administration or insolvency of the Consultant or any person.
- (f) If any sum due or purportedly due under this Guarantee is not or would not be recoverable under a guarantee for any reason whatsoever, whether or not known to you, such sum shall still be recoverable from us as a sole principal debtor upon the terms of this Guarantee.

- (g) All Call Off Contracts issued pursuant to the Framework Agreement are within the scope of this Guarantee.

PROVIDED THAT:

1. We shall be under no greater obligation or greater liability under this Guarantee than we would have been under the Framework Agreement or relevant Call Off Contract if we had been named as the Consultant in the Framework Agreement or relevant Call Off Contract.
2. Our obligations hereunder are those of primary obligor and shall remain in full force and effect and shall not be terminated, reduced, discharged or otherwise affected by:
 - (a) any alteration or variation to the terms of the Framework Agreement or any Call Off Contract made by agreement between you (or the relevant employer under a Call Off Contract) and the Consultant (including, without limitation, any increase in the Consultant's obligations under the Framework Agreement or any Call Off Contract or any alteration in the extent or nature or sequence or method or timing of the services to be carried out under the Framework Agreement or any Call Off Contract) or any novation of any Call Off Contract (in whole or in part); or
 - (b) any time being given to the Consultant or any other indulgence, waiver, concession, forbearance or forgiveness to the Consultant (whether express or by conduct) or any other thing done, omitted or neglected to be done under the Framework Agreement or any Call Off Contract; or
 - (c) any other bond, security or guarantee now or hereafter given for all or any part of the obligations of the Consultant under the Framework Agreement or any Call Off Contract; or
 - (d) the release or waiver of any such bond, security or guarantee referred to in paragraph 2(c) above; or
 - (e) any amalgamation, reconstruction or dissolution including, without limitation, winding-up of the Consultant; or
 - (f) the winding-up, bankruptcy, administration, receivership or insolvency of the Consultant; or
 - (g) any legal limitation, disability or incapacity relating to the Consultant or discharge by operation of law or any change in the constitution, name or style of the Consultant or any other person (whether or not known to you); or
 - (h) any total or partial invalidity in, irregularity affecting or unenforceability of any of the obligations of the Consultant under the Framework Agreement or any Call Off Contract; or
 - (i) the termination or partial termination of the Framework Agreement or any Call Off Contract or the cessation of any services for any reason or the making of any variation to the services in accordance with the Framework Agreement or any Call Off Contract; or
 - (j) any claim or enforcement of payment from the Consultant or any other person;
 - (k) any act or omission which would not have discharged or affected the liability of a sole principal debtor instead of a guarantor or any act or omission, matter or thing which, but for this provision, might operate to exonerate, discharge, reduce or extinguish our liability under this Guarantee.
3. So long as we remain under any actual or contingent liability under this Guarantee, we shall not exercise any right of subrogation or any other right or remedy which we may have against the Consultant in respect of any payment made by or sum recovered from us pursuant to or in connection with this Guarantee or prove in any liquidation of the Consultant in competition for any sums or liabilities owing or incurred to us by the Consultant in respect of any such payment by or recovery from us or take or hold any security from the Consultant in respect of any liability of ours hereunder. We shall hold any monies recovered or security taken or held in breach of this provision in trust for you or the relevant employer under the Call Off Contract (as the case may be).
4. Except where prevented from doing so by law, we waive and agree not to enforce or claim the benefit of any and all rights we have or may from time to time have as guarantor under any applicable law which is or may be inconsistent with any of the provisions of this Guarantee.

5. This Guarantee is irrevocable.
6. Save that any member of the TfL Group (as defined in the Framework Agreement) has the right to enforce the terms of this Guarantee in accordance with the Contracts (Rights of Third Parties) Act 1999 ("Third Party Act"), the parties do not intend that any of the terms of this Guarantee are enforceable by virtue of the Third Party Act by any person not a party to it.
7. Notwithstanding clause 6, the parties are entitled to vary or rescind this Guarantee without the consent of any or all members of the TfL Group (other than you).
8. This Guarantee, executed and delivered as a deed, is governed by and shall be construed in accordance with the law of England and Wales. The courts of England shall have exclusive jurisdiction to settle any dispute which may arise out of or in connection with this Guarantee except that you have the right in your absolute discretion to enforce a judgment and/or to take proceedings in any other jurisdiction in which we are incorporated or in which any of our assets may be situated. You and we agree to submit to that jurisdiction.

[For non-UK resident Guarantors only:

9. For the purposes of this Guarantee we hereby appoint of (to be a London address) to accept service of process on our behalf, and service on the said at the said address shall be deemed to be good service on us; and we hereby irrevocably agree not to revoke or terminate such appointment.]
10. You will be entitled to assign the benefit of this Guarantee in whole or in part but we may not assign the benefit and/or delegate the burden of this Guarantee in whole or in part or enter into any transaction which would result in any of those benefits and/or burdens passing to another person.
11. If any provision (in whole or in part) of this Guarantee is found by any court, tribunal, administrative body or authority of competent jurisdiction to be wholly or partly illegal, invalid or unenforceable then that provision shall, to the extent required, be severed from this Guarantee and shall be ineffective, without, so far as is possible, modifying any other provision of this Guarantee and this shall not affect any other provisions of this Guarantee which shall remain in full force and effect.

Executed as a Deed and delivered the day and year written above.

Executed as a Deed by _____)
[Parent Company]) Director
 acting by a Director and the)
 Secretary or by two Directors) _____
 Director/Secretary

OR
 The common seal of _____)
[Parent Company]) Director
 was affixed in the presence of:)
 _____)
 Director/Secretary

Form of Legal Opinion for use with Guarantee (Framework Agreement)

To: [insert name and address of the Framework Employer]

Date:

Dear Sir/Madam

I am counsel to and I am giving this legal opinion in connection with the making by of the Guarantee (as defined below) in your favour.

1. I have examined the Deed of Guarantee (the "Guarantee") dated made between (the "Guarantor") and Transport for London ("the Employer"). Terms defined in or for the purpose of the Guarantee have the same meanings in this opinion.
2. Having considered the Guarantee and examined any other document, resolution or certificate I deemed necessary to enable me to give the opinion contained herein and having regard to all applicable laws of I am pleased to advise that in my opinion:
 - (a) the Guarantor was incorporated in on as a [company with limited liability] and validly exists under the laws of as a separate legal entity possessing the capacity to sue or be sued in its own name. To the best of my knowledge having carried out [DESCRIBE APPLICABLE SEARCHES] today, no steps have been, or are being, taken to appoint a receiver or liquidator (or similar encumbrancer or officer) over, or to wind up, the Guarantor;
 - (b) the Guarantor has the necessary power and authority, and all necessary corporate and other action (including, without limitation, approvals and consents of members, stockholders, debenture holders or governmental or other regulatory authorities) has been taken to enable the Guarantor to enter into the Guarantee and to perform the obligations of the Guarantor and the transactions contemplated thereby; and
 - (c) The entry into and performance of the Guarantee and the transactions contemplated thereby will not cause:
 - (i) any limit on the Guarantor or its directors (whether imposed by the documents constituting the Guarantor, statute, regulation, agreement or otherwise) to be exceeded;
 - (ii) any law or order or constitutional document in respect of the Guarantor to be contravened;
 - (iii) any default under, or give rise to an obligation to create or impose any security interest of any nature whatsoever pursuant to, any agreement or other instrument or any judgment or other requirement known to us after due enquiry to which the Guarantor is a party or by which it or any of its assets is bound. Further, no event has occurred that, with the giving of notice, lapse of time, determination of materiality or other conditions might constitute a default under or in respect of such agreement, instrument or judgment;
 - (d) the Guarantee has been properly signed and delivered on behalf of the Guarantor and the obligations on the part of the Guarantor contained in the Guarantee, assuming them to be valid and binding according to English law by which they are expressed to be governed, are valid, legally binding on and enforceable against the Guarantor under the laws of and in the courts of
 - (e) the signature, delivery and performance of the Guarantee by the Guarantor constitute private and commercial acts by it rather than public or governmental acts;
 - (f) all authorisations, approvals, consents, licences, exemptions, filings, registrations, notarisations and other requirements of governmental, judicial and public bodies and authorities of or in [COUNTRY] required or advisable in connection with the entry into, performance, validity and enforceability of the Guarantee and the transactions contemplated thereby have been obtained or effected and are in full force and effect;

- (g) the obligations of the Guarantor under the Guarantee rank at least equally and rateably (pari passu) in point of priority and security with any and all other unsecured obligations of the Guarantor;
- (h) all amounts payable by the Guarantor under the Guarantee may be made free and clear of, and without deduction for, or on account of, any taxes imposed, assessed or levied by [COUNTRY] or any authority of or in [COUNTRY];
- (i) there are no registration, stamp or other taxes or duties of any kind payable in in connection with the Guarantor including its signature, performance or enforcement by legal proceedings;
- (j) The Employer will not violate any law or regulation in nor become liable to tax in by reason of entering into the Guarantee or performing its obligations thereunder. It is not necessary to establish a place of business in in order to enforce any provisions of the Guarantee;
- (k) the choice of English law to govern the Guarantee will be upheld as a valid choice of law in any action in respect of the Guarantee in the Courts;
- (l) the consent to the jurisdiction by the Guarantor contained in the Guarantee is valid and binding on the Guarantor and not subject to revocation;
- (m) any judgment obtained in the courts of England against the Guarantor would be recognised and accepted by the courts without re-trial or re-examination of the merits of the case;
- (n) neither the Guarantor nor any of its assets enjoys any right or immunity from set-off, suit or execution in respect of its obligations under the Guarantee;
- (o) so far as I am aware after due enquiry, no litigation, arbitration or administrative proceedings are at present current, pending or threatened that might, if adversely determined, have a material effect on the business, assets or financial condition of the Guarantor.

3. I do not purport to be expert on and do not purport to be generally familiar with or qualified to express legal opinions based on any law other than the laws of and accordingly express no legal opinion herein based upon any law other than the laws of

Signed

Schedule 4B
(Form of Parent Company Guarantee - Call Off Contract)

Form of Parent Company Guarantee - Call Off Contract

(Letterhead of Parent Company)

To: [insert name and address of the Employer]

Date:

Dear Sir/Madam

We, [insert name of Guarantor] ("**the Guarantor**"), understand that you have agreed to enter into a Call Off Contract No [insert reference] ("**the Call Off Contract**") with [insert name of Consultant] ("**the Consultant**") in respect of [briefly describe nature of the Services/Project] on the condition that the obligations of the Consultant under the Call Off Contract be guaranteed by a Guarantor.

We are [recite the relationship of the Guarantor to the Consultant], and we warrant to you that this description of our relationship with/to the Consultant is true and accurate in all material respects.

WE HEREBY AGREE AND UNDERTAKE with you as follows:-

- (a) We unconditionally guarantee on demand:
- (i) the proper, complete and punctual performance by the Consultant of any and all its obligations, undertakings and responsibilities under the Call Off Contract and we shall forthwith make good any default there under on the part of the Consultant;
 - (ii) the due and punctual payment by the Consultant of all sums, liabilities, awards, losses, damages, costs, charges and expenses that may be or become due and payable under or arising out of the Call Off Contract in accordance with its terms or otherwise by reason or in consequence of any such default on the part of the Consultant
- 1.1.1 when and as the same shall become due for performance or payment (as the case may be).
- (b) As a separate and primary obligation we unconditionally guarantee to you that in the case of default by the Consultant in making any of the payments or in performing any of the obligations, undertakings and responsibilities set out in paragraph (a) above, we shall on demand pay all sums and observe and perform any or all of such obligations, undertakings and responsibilities as if we instead of the Consultant were the primary obligor. Any payment under this Guarantee shall be made by us in pounds sterling or in any currency which may from time to time replace pounds sterling.
- (c) This Guarantee shall be a continuing security and shall remain in full force and effect until all obligations to be performed or observed by the Consultant under or arising out of the Call Off Contract have been duly and completely performed and observed and the Consultant shall have ceased to be under any actual or contingent liability to you thereunder.
- (d) Any demand or other notice made by you under this Guarantee shall be duly made if sent by first class recorded delivery post to us.
- (e) You shall be entitled to enforce this Guarantee without first notifying the Consultant of any default or taking any proceedings or demanding upon, enforcing or exhausting any right or remedy against the Consultant or any other person or taking any action to enforce any other security, bond or guarantee held by you or making or filing any claim in a bankruptcy, liquidation, administration or insolvency of the Consultant or any person.
- (f) If any sum due or purportedly due under this Guarantee is not or would not be recoverable under a guarantee for any reason whatsoever, whether or not known to you, such sum shall still be recoverable from us as a sole principal debtor upon the terms of this Guarantee.

PROVIDED THAT:

1. We shall be under no greater obligation or greater liability under this Guarantee than we would have been under the Call Off Contract if we had been named as the Consultant in the Call Off Contract.
2. Our obligations hereunder are those of primary obligor and shall remain in full force and effect and shall not be terminated, reduced, discharged or otherwise affected by:

- (a) any alteration or variation to the terms of the Call Off Contract made by agreement between you and the Consultant (including, without limitation, any increase in the Consultant's obligations under the Call Off Contract or any alteration in the extent or nature or sequence or method or timing of the services to be carried out under the Call Off Contract) or any novation of the Call Off Contract (in whole or in part); or
- (b) any time being given to the Consultant or any other indulgence, waiver, concession, forbearance or forgiveness to the Consultant (whether express or by conduct) or any other thing done, omitted or neglected to be done under the Call Off Contract; or
- (c) any other bond, security or guarantee now or hereafter held by you for all or any part of the obligations of the Consultant under the Call Off Contract; or
- (d) the release or waiver of any such bond, security or guarantee referred to in paragraph 2(c) above; or
- (e) any amalgamation, reconstruction or dissolution including, without limitation, winding-up of the Consultant; or
- (f) the winding-up, bankruptcy, administration, receivership or insolvency of the Consultant; or
- (g) any legal limitation, disability or incapacity relating to the Consultant or discharge by operation of law or any change in the constitution, name or style of the Consultant or any other person (whether or not known to you); or
- (h) any total or partial invalidity in, irregularity affecting or unenforceability of any of the obligations of the Consultant under the Call Off Contract; or
- (i) the termination or partial termination of the Call Off Contract or the cessation of any services for any reason or the making of any variation to the services in accordance with the Call Off Contract; or
- (j) any claim or enforcement of payment from the Consultant or any other person;
- (k) any act or omission which would not have discharged or affected the liability of a sole principal debtor instead of a guarantor or any act or omission, matter or thing which, but for this provision, might operate to exonerate, discharge, reduce or extinguish our liability under this Guarantee.

3. So long as we remain under any actual or contingent liability under this Guarantee, we shall not exercise any right of subrogation or any other right or remedy which we may have against the Consultant in respect of any payment made by or sum recovered from us pursuant to or in connection with this Guarantee or prove in any liquidation of the Consultant in competition with you for any sums or liabilities owing or incurred to us by the Consultant in respect of any such payment by or recovery from us or take or hold any security from the Consultant in respect of any liability of ours hereunder. We shall hold any monies recovered or security taken or held in breach of this provision in trust for you.
4. Except where prevented from doing so by law, we waive and agree not to enforce or claim the benefit of any and all rights we have or may from time to time have as guarantor under any applicable law which is or may be inconsistent with any of the provision of this Guarantee.
5. This Guarantee is irrevocable.
6. This Guarantee, executed and delivered as a deed, is governed by and shall be construed in accordance with the law of England and Wales. The courts of England shall have exclusive jurisdiction to settle any dispute which may arise out of or in connection with this Guarantee except that you have the right in your absolute discretion to enforce a judgment and/or to take proceedings in any other jurisdiction in which we are incorporated or in which any of our assets may be situated. You and we agree to submit to that jurisdiction.

[For non-UK resident Guarantors only:

7. For the purposes of this Guarantee we hereby appoint of (to be a London address) to accept service of process on our behalf, and service on the said at the

said address shall be deemed to be good service on us; and we hereby irrevocably agree not to revoke or terminate such appointment.]

8. You will be entitled to assign the benefit of this Guarantee in whole or in part but we may not assign the benefit and/or delegate the burden of this Guarantee in whole or in part or enter into any transaction which would result in any of those benefits and/or burdens passing to another person.
9. If any provision (in whole or in part) of this Guarantee is found by any court, tribunal, administrative body or authority of competent jurisdiction to be wholly or partly illegal, invalid or unenforceable then that provision shall, to the extent required, be severed from this Guarantee and shall be ineffective, without, so far as is possible, modifying any other provision of this Guarantee and this shall not affect any other provisions of this Guarantee which shall remain in full force and effect.

Executed as a Deed and delivered the day and year written above.

Executed as a Deed by) _____
<i>[Parent Company]</i>) Director
acting by a Director and the) _____
Secretary or by two Directors) _____
	Director/Secretary
OR	
The common seal of) _____
<i>[Parent Company]</i>) Director
was affixed in the presence of:)) _____
	Director/Secretary

Form of Legal Opinion for use with Guarantee (Call Off Contract)

To: [insert name and address of the Employer]

Date:

Dear Sir/Madam

I am counsel to and I am giving this legal opinion in connection with the making by of the Guarantee (as defined below) in your favour.

1. I have examined the Deed of Guarantee (the "Guarantee") dated made between (the "Guarantor") and [insert name of Employer] ("the Employer"). Terms defined in or for the purpose of the Guarantee have the same meanings in this opinion.
2. Having considered the Guarantee and examined any other document, resolution or certificate I deemed necessary to enable me to give the opinion contained herein and having regard to all applicable laws of I am pleased to advise that in my opinion:
 - (a) the Guarantor was incorporated in on as a [company with limited liability] and validly exists under the laws of as a separate legal entity possessing the capacity to sue or be sued in its own name. To the best of my knowledge having carried out [DESCRIBE APPLICABLE SEARCHES] today, no steps have been, or are being, taken to appoint a receiver or liquidator (or similar encumbrancer or officer) over, or to wind up, the Guarantor;
 - (b) the Guarantor has the necessary power and authority, and all necessary corporate and other action (including, without limitation, approvals and consents of members, stockholders, debenture holders or governmental or other regulatory authorities) has been taken to enable the Guarantor to enter into the Guarantee and to perform the obligations of the Guarantor and the transactions contemplated thereby; and
 - (c) The entry into and performance of the Guarantee and the transactions contemplated thereby will not cause:
 - (i) any limit on the Guarantor or its directors (whether imposed by the documents constituting the Guarantor, statute, regulation, agreement or otherwise) to be exceeded;
 - (ii) any law or order or constitutional document in respect of the Guarantor to be contravened;
 - (iii) any default under, or give rise to an obligation to create or impose any security interest of any nature whatsoever pursuant to, any agreement or other instrument or any judgment or other requirement known to us after due enquiry to which the Guarantor is a party or by which it or any of its assets is bound. Further, no event has occurred that, with the giving of notice, lapse of time, determination of materiality or other conditions might constitute a default under or in respect of such agreement, instrument or judgment;
 - (d) the Guarantee has been properly signed and delivered on behalf of the Guarantor and the obligations on the part of the Guarantor contained in the Guarantee, assuming them to be valid and binding according to English law by which they are expressed to be governed, are valid, legally binding on and enforceable against the Guarantor under the laws of and in the courts of
 - (e) the signature, delivery and performance of the Guarantee by the Guarantor constitute private and commercial acts by it rather than public or governmental acts;
 - (f) all authorisations, approvals, consents, licences, exemptions, filings, registrations, notarisations and other requirements of governmental, judicial and public bodies and authorities of or in [COUNTRY] required or advisable in connection with the entry into, performance, validity and enforceability of the Guarantee and the

transactions contemplated thereby have been obtained or effected and are in full force and effect;

- (g) the obligations of the Guarantor under the Guarantee rank at least equally and rateably (pari passu) in point of priority and security with any and all other unsecured obligations of the Guarantor;
- (h) all amounts payable by the Guarantor under the Guarantee may be made free and clear of, and without deduction for, or on account of, any taxes imposed, assessed or levied by [COUNTRY] or any authority of or in [COUNTRY];
- (i) there are no registration, stamp or other taxes or duties of any kind payable in in connection with the Guarantor including its signature, performance or enforcement by legal proceedings;
- (j) The Employer will not violate any law or regulation in nor become liable to tax in by reason of entering into the Guarantee or performing its obligations thereunder. It is not necessary to establish a place of business in in order to enforce any provisions of the Guarantee;
- (k) the choice of English law to govern the Guarantee will be upheld as a valid choice of law in any action in respect of the Guarantee in the Courts;
- (l) the consent to the jurisdiction by the Guarantor contained in the Guarantee is valid and binding on the Guarantor and not subject to revocation;
- (m) any judgment obtained in the courts of England against the Guarantor would be recognised and accepted by the courts without re-trial or re-examination of the merits of the case;
- (n) neither the Guarantor nor any of its assets enjoys any right or immunity from set-off, suit or execution in respect of its obligations under the Guarantee;
- (o) so far as I am aware after due enquiry, no litigation, arbitration or administrative proceedings are at present current, pending or threatened that might, if adversely determined, have a material effect on the business, assets or financial condition of the Guarantor.

3. I do not purport to be expert on and do not purport to be generally familiar with or qualified to express legal opinions based on any law other than the laws of and accordingly express no legal opinion herein based upon any law other than the laws of

Signed

SCHEDULE 7C
(Call Off Contract Form of Variation)

SCHEDULE 7C – CALL OFF CONTRACT FORM OF VARIATION

Contract Parties: [to be inserted]
 Contract Number: [to be inserted]
 Variation Number: [to be inserted]
 The Employer Contact Telephone [to be inserted]
 Fax [to be inserted]
 Date: [to be inserted]

THE EMPLOYER FOR VARIATION TO CONTRACT (AVC)

Pursuant to Clause 30 of the Contract, authority is given for the variation to the Services and the Charges as detailed below. The duplicate copy of this form must be signed by or on behalf of the Consultant and returned to the Procurement Manager as an acceptance by the Consultant of the variation shown below.

DETAILS OF VARIATION	AMOUNT (£)
ALLOWANCE TO THE THE EMPLOYER	•
EXTRA COST TO THE THE EMPLOYER	•
TOTAL	•

..... (print name)
 For the The Employer (signed)

ACCEPTANCE BY THE CONSULTANT	
Date	Signed

SCHEDULE 9
(Form of Warranty from Consultant to Financier or Purchaser/Tenant/Developer)

THIS DEED is made on ● 200●

BETWEEN:

- (1) ● whose registered office is situate at ● (the "**Beneficiary**"); and
- (2) ● whose registered office is situate at ● (the "**Consultant**").

WHEREAS:

- (A) By a call off contract dated ● (the "**Contract**") [EMPLOYER] whose registered office is at [ADDRESS] ("the *Employer*", which expression shall include its successors in title and assigns) appointed the *Consultant* to design, carry out and complete certain [DESCRIPTION OF SERVICES] at ● (the "**services**") at ● (the "**Works**").
- (B) [The Beneficiary [intends to enter into] / [has entered into] an agreement to provide finance for the carrying out and completion of the *services*. [The Beneficiary [intends to enter into] / [has entered into] an agreement with the *Employer* under which it will agree that on or following Completion of the *services* it will [purchase] / [take a lease of] the whole or part of the Main Contract Works or the Works]. [The Beneficiary has an interest in the whole or part of the *services* as a developer and [intends to enter into] / [has entered into] an agreement with the *Employer* in respect of [●].]

NOW IT IS AGREED:

- 1. Terms and expressions defined in the Contract shall where the context so permits have the same meanings in this Deed.
- 2. The *Consultant* warrants and undertakes to the Beneficiary that:
 - (a) it has exercised and will continue to exercise all the skill, care and diligence normally used by professionals providing services similar to the *services*, including in respect of design all reasonable skill, care and diligence as may be expected of a properly qualified designer of the appropriate discipline(s) for such design, experienced in carrying out design of a similar scope, nature, timescale and complexity and relating to a similar site or at a similar location to the Works; and
 - (b) it has complied with and will continue to comply with the terms of the Contract.
- 3.
 - 3.1 The *Consultant* warrants and undertakes to the Beneficiary that to the extent the *Consultant* either is obliged to specify or approve products or materials for use or does so specify or approve, the *Consultant* does not specify or approve any products or materials which are generally known within the construction industry to be deleterious at the time of specification or approval in the particular circumstances in which they are to be used, or those identified as potentially hazardous in or not in conformity with:
 - (a) the report entitled "Good Practice in the Selection of Construction Materials" (1997, by Tony Sheehan, Ove Arup & Partners, published by the British Council for Offices and the British Property Federation), or
 - (b) relevant International Standards, British Standards or European Standards or Codes of Practice and general good building and engineering practice, or
 - (c) any publications of the Building Research Establishment related to the specification of products or materials.
 - 3.2 If in the performance of his duties under the Contract, the *Consultant* becomes aware that he or any person has specified, approved or used any such products or materials, the *Consultant* immediately notifies the Beneficiary in writing. This clause does not create any additional duty for the *Consultant* to inspect or check the work of Others which is not required by the Contract

4. The *Consultant* further warrants and undertakes to the Beneficiary that:
 - (a) subject to clause 2(a), the *services* will on Completion satisfy all performance or output specifications and other requirements contained or referred to in the Contract;
 - (b) subject to clause 2(a), the *services* and all materials comprised in them will correspond as to description, quality and condition with the requirements of the Contract and will be of sound manufacture and workmanship;
 - (c) his designs are integrated with the designs of Others [and in particular the Infraco(s) and PFI Contractor(s)]; **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
 - (d) the *services* will on Completion comply with the Statutory Requirements, all applicable law and all relevant Standards; and
 - (e) the *services* will be carried out and completed timeously in accordance with the Accepted Programme.

5. The *Consultant* warrants and undertakes to the Beneficiary that it has maintained and will continue to maintain all insurances required to be maintained pursuant to the terms of the Contract and that it has professional indemnity insurance with a limit of indemnity of not less than £[2/5 million] [in respect of each and every claim and in the aggregate] which may be made against the *Consultant* in relation to the Works. The *Consultant* shall maintain such professional indemnity insurance for a period of 12 years from Completion of the whole of the *services* provided such insurance remains available at commercially reasonable rates and shall notify the Beneficiary forthwith if such insurance ceases to be so available. When deciding whether such insurances are available at commercially reasonable rates, no account shall be taken of any increase in the premium or imposition of terms which arise as a result of the *Consultant's* insurance claims record.
6. As and when reasonably requested by the Beneficiary, the *Consultant* shall produce for inspection documentary evidence that the insurance referred to in Clause 5 is being properly maintained and that payment has been made of the last premium due in respect of such insurance.
7. To the extent that the intellectual property rights in any and all designs, drawings, models, plans, specifications, design details, photographs, brochures, reports, notes of meetings, CAD materials, manuals, instructions (including without limitation operating and maintenance instructions) and any other materials provided by the *Consultant* in connection with the *services* (whether in existence or to be made) ("Documents") have not already vested in the *Employer*, the *Consultant* grants to the Beneficiary an irrevocable, non-exclusive, non-terminable, royalty-free licence to copy and make full use of any and all Documents and all amendments and additions to them and any works, designs or inventions of the *Consultant* incorporated or referred to in them for all purposes relating to the *services* including without limitation the construction, use, maintenance, repair, alteration, modification, enhancement or demolition of the Works provided always that the *Consultant* shall not be liable for the consequences of any use of the Documents as aforesaid for any other purpose. Such licence shall carry the right to grant sub-licences and shall be transferable to third parties without the prior consent of the *Consultant*.
8. The *Consultant* agrees:
 - (a) on request at any time to give the Beneficiary or any persons authorised by the Beneficiary access to the material referred to in Clause 7 and at the Beneficiary's expense to provide copies of any such material; and
 - (b) at the *Consultant's* expense to provide the Beneficiary with a set of all such material on Completion of the *services*.

9. If called upon to do so by the Beneficiary, the *Consultant* shall provide the Beneficiary with such information relating to the *services* as the Beneficiary may reasonably require including without limitation, copies of and extracts from Documents prepared or provided by the *Consultant* for the purposes of the *services* provided that neither the provision of such information nor any inspection of the *services* by the Beneficiary or its agents nor the approval by the Beneficiary or its agents of any material shall limit or discharge, or be deemed to limit

- or discharge the obligations of the *Consultant* under the Contract or relieve the *Consultant* from any liability which it has in relation to the *services*.
10. This Deed may be assigned by the Beneficiary to any member of the TfL Group without limitation and otherwise to any other person on two occasions without the consent of the *Consultant* being required and the *Consultant* shall do all such acts, deeds and things as may be reasonably necessary to give effect to any such assignment. No further assignment shall be permitted without the consent of the *Consultant*. For the purposes of this clause, "TfL Group" means Transport for London ("TfL"), a statutory body set up by the Greater London Authority Act 1999 and all its subsidiaries and their subsidiaries (as defined in section 736 of the Companies Act 1985) from time to time together with Cross London Rail Links Limited (company number 04212657) and reference to any "member of the TfL Group" refers to TfL or any such subsidiary. [The *Employer* is a member of the TfL Group].
 11. The *Consultant* shall not be entitled to contend that any person to whom this Deed is assigned in accordance with Clause 10 is precluded from recovering under this Deed any loss incurred by such assignee resulting from any breach of this Deed (whenever happening) by reason that such person is an assignee and not a named promisee under this Deed.
 12. The liability of the *Consultant* under this Deed shall cease 12 years following Completion of the whole of the *services*.
 13. The rights and benefits conferred upon the Beneficiary by this Deed are in addition to any other rights and remedies the Beneficiary may have against the *Consultant* including without limitation any remedies in negligence.
 - 14.1 The *Consultant* shall owe no greater obligations to the Beneficiary than he owes to the *Employer* under the Contract as if, in lieu of this Deed, the Beneficiary had been a party to the Contract as joint employer, provided that the *Consultant* shall not be entitled to set-off or deduct from any sums payable to the Beneficiary under this Deed any sums due or claimed as due by the *Consultant* from the *Employer*.
 - 14.2 The *Consultant* shall be entitled in any actions or proceedings brought by the Beneficiary to rely on any limitation in the Contract and to raise the equivalent rights in defence of liability as he would have against the *Employer* thereunder (but excluding set-offs and counterclaims) as if, in lieu of this Deed, the Beneficiary had been a party to the Contract as joint employer.
 15. Any notice to be given hereunder shall be deemed to be duly given if it is in writing and delivered by hand at or sent by registered post to the registered office or principle place of business in the United Kingdom for the time being of the party to be served and in the case of any such notice sent by registered post shall be deemed to have been received 48 hours after being posted.
 - 16.1 Any dispute or difference arising out of or in connection with this Deed may be referred to adjudication in accordance with Clause 41 of the Framework Agreement which shall be deemed to be included in this Deed as if they were recited herein in full (with the necessary changes).
 - 16.2 The Adjudicator's decision shall be binding on the parties until the dispute or difference is finally determined by the Courts in accordance with Clause 16.3.
 - 16.3 The Courts of England and Wales shall have jurisdiction over any dispute or difference arising out of or in connection with this Deed. The Law of England and Wales shall be the proper law of this Deed.
 17. Nothing in this Deed confers or is intended to confer on any third party any benefit or the right to enforce any term of this Deed pursuant to the Contracts (Rights of Third Parties) Act 1999.
 18. **IN WITNESS** whereof this Deed has been executed and unconditionally delivered as a Deed by the parties the day and year first above written.

**[EXECUTED AND DELIVERED AS
A DEED by
[THE BENEFICIARY]** acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

**[EXECUTED AND DELIVERED AS
A DEED by
[THE CONSULTANT]** acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

SCHEDULE 10
(Form of warranty from *Consultant* to *Employer* upon novation)

THIS DEED is made on ● 201 ●

BETWEEN:

- (1) ● whose registered office is situate at ● (the "**Employer**" which expression shall include its successors and assigns);
- (2) ● whose registered office is situate at ● (the "**Consultant**"); and
- (3) ● whose registered office is situate at ● [(the "**Contractor**")].

WHEREAS:

- (A) By a call off contract dated ● (the "**Contract**") the *Employer* appointed the *Consultant* to design, carry out and complete certain [SERVICES] (the "**services**") at ● ("the **Works**").
- (B) [Pursuant to a contract dated ● (the "**Main Works Contract**") the *Employer* has appointed the Contractor to design, carry out and complete certain works in respect of the Works ("the **Main Contract Works**").]
- (C) [The *Employer* has novated the Contract to the [Contractor] by a Deed of Novation dated ●.]
- (D) The *Consultant* has agreed to execute this Deed in favour of the *Employer*.

NOW IT IS AGREED:

1. Terms and expressions defined in the Contract shall where the context so permits have the same meanings in this Deed. The following expression has the meaning set out herein:
 - (a) "Documents" means designs, drawings, models, plans, specifications, design details, photographs, brochures, reports, notes of meetings, CAD materials, manuals, instructions (including without limitation operating and maintenance instructions) and any other materials provided by the *Consultant* in connection with the *services* (whether in existence or to be made);
2. The *Consultant* warrants and undertakes to the *Employer* that:
 - (a) it has exercised and will continue to exercise all the skill, care and diligence normally used by professionals providing services similar to the *services*, including in respect of design all reasonable skill, care and diligence as may be expected of a properly qualified designer of the appropriate discipline(s) for such design, experienced in carrying out design of a similar scope, nature, timescale and complexity and relating to a similar site or at a similar location to the Works; and
 - (b) it has complied with and will continue to comply with the terms of the Contract.
3.
 - 3.1 The *Consultant* warrants and undertakes to the Beneficiary that to the extent the *Consultant* either is obliged to specify or approve products or materials for use or does so specify or approve, the *Consultant* does not specify or approve any products or materials which are generally known within the construction industry to be deleterious at the time of specification or approval in the particular circumstances in which they are to be used, or those identified as potentially hazardous in or not in conformity with:
 - (a) the report entitled "Good Practice in the Selection of Construction Materials" (1997, by Tony Sheehan, Ove Arup & Partners, published by the British Council for Offices and the British Property Federation), or
 - (b) relevant International Standards, British Standards or European Standards or Codes of Practice and general good building and engineering practice, or
 - (c) any publications of the Building Research Establishment related to the specification of products or materials.

- 3.2 If in the performance of his duties under the Contract, the *Consultant* becomes aware that he or any person has specified, approved or used any such products or materials, the *Consultant* immediately notifies the Beneficiary in writing. This clause does not create any additional duty for the *Consultant* to inspect or check the work of Others which is not required by the Contract
4. The *Consultant* further warrants and undertakes to the *Employer* that:
- (a) subject to clause 2(a), the *services* will on Completion satisfy all performance or output specifications and other requirements contained or referred to in the Contract;
 - (b) subject to clause 2(a), the *services* and all materials comprised in them will correspond as to description, quality and condition with the requirements of the Contract and will be of sound manufacture and workmanship;
 - (c) his designs are integrated with the designs of Others [and in particular the Infraco(s) and PFI Contractor(s)]; **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
 - (d) the *services* will on Completion comply with the Statutory Requirements, all applicable law and all relevant Standards;
 - (e) the *services* will be carried out and completed timeously in accordance with the Accepted Programme;
 - (f) he shall not commit a Safety Breach; and
 - (g) [the *services* will not on Completion render the Works incapable of being Available.]
[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]
5. The *Consultant* warrants and undertakes to the *Employer* that it has maintained and will continue to maintain all insurances required to be maintained pursuant to the terms of the Contract and that it has professional indemnity insurance with a limit of indemnity of not less than £[2/5 million] [in respect of each and every claim and in the aggregate] which may be made against the *Consultant* in relation to the *services*. The *Consultant* shall maintain such professional indemnity insurance for a period of 12 years from Completion of the whole of the *services* provided such insurance remains available at commercially reasonable rates and shall notify the *Employer* forthwith if such insurance ceases to be so available. When deciding whether such insurances are available at commercially reasonable rates, no account shall be taken of any increase in the premium or imposition of terms which arise as a result of the *Consultant's* insurance claims record.
6. As and when reasonably requested by the *Employer*, the *Consultant* shall produce for inspection documentary evidence that the insurance referred to in Clause 5 is being properly maintained and that payment has been made of the last premium due in respect of such insurance.
7. To the extent that the intellectual property rights in any and all Documents have not already vested in the *Employer*, the *Consultant* grants to the *Employer* an irrevocable, non-exclusive, non-terminable, royalty-free licence to copy and make full use of any and all Documents and all amendments and additions to them and any works, designs or inventions of the *Consultant* incorporated or referred to in them for all purposes relating to the *services* including without limitation the construction, use, maintenance, repair, alteration, modification, enhancement or demolition of the Works provided always that the *Consultant* shall not be liable for the consequences of any use of the Documents as aforesaid for any other purpose. Such licence shall carry the right to grant sub-licences and shall be transferable to third parties without the prior consent of the *Consultant*.
8. The *Consultant* agrees:
- (a) on request at any time to give the *Employer* or any persons authorised by the *Employer* access to the material referred to in Clause 7 and at the *Employer's* expense to provide copies of any such material; and
 - (b) at the *Consultant's* expense to provide the *Employer* with a set of all such material on Completion of the *services*.

9. If called upon to do so by the *Employer*, the *Consultant* shall provide the *Employer* with such information relating to the *services* as the *Employer* may reasonably require including without limitation, copies of and extracts from Documents prepared or provided by the *Consultant* for the purposes of the *services* provided that neither the provision of such information nor any inspection of the *services* by the *Employer* or its agents nor the approval by the *Employer* or its agents of any material shall limit or discharge, or be deemed to limit or discharge the obligations of the *Consultant* under the Contract or relieve the *Consultant* from any liability which it has in relation to the *services*.
10. The *Consultant* warrants and undertakes to the *Employer* that he shall maintain and retain the Minimum Records for a minimum of twelve (12) years from Completion of the *services* with respect to all matters for which the *Consultant* is responsible under the Contract. The *Consultant* further warrants and undertakes to the *Employer* that the Contract contains open-book audit rights in favour of the *Employer* and its authorised representatives and that he shall undertake his obligations and exercise his rights under the Contract on an open-book basis. The *Employer* and his authorised representatives may from time to time audit on an open-book basis and check and take copies of and extracts from any document or record of the *Consultant* including, without limitation the Minimum Records. The *Consultant* further warrants that it shall promptly provide all reasonable co-operation in relation to any audit or checking including, without limitation, granting access to premises, equipment, systems and senior personnel and making documents available. Without prejudice to the foregoing, the *Consultant* acknowledges and agrees that the *Employer* may audit and check any and all records as are necessary in order to monitor compliance with the *Consultant's* obligations under the Contract with respect to Safety Breaches at any time during performance of the Contract and during the 12 years thereafter.
- 11.1 Without limitation to Clause 2 above, the *Consultant* hereby warrants to the *Employer* that:
- (a) except as provided under deeds of warranty required under clause 100.1 of the Conditions of Contract, it shall not, without the prior written approval of the *Employer*, at any time for any reason disclose to any person or publish or make any statement concerning the Contract, this Deed or the Works;
 - (b) it shall treat all information obtained under, arising from or in connection with the Contract, this Deed and the Works as confidential, and that other than for the purpose of providing the *services*, it shall not disclose any information or documents concerning the Contract to any other person; and
 - (c) it shall not, without the prior written consent of the *Employer*, disclose any information obtained by it concerning the *Employer* or the TfL Group to any other person.
- 11.2 The *Employer* may require as a precondition to the granting of such consent that any such third party provides a confidentiality undertaking in terms satisfactory to the *Employer*.
- 11.3 Clause 11.1 does not apply to the disclosure of:
- (a) any information which is already in the public domain at the time of its disclosure other than by breach of these provisions,
 - (b) any information disclosed by the *Consultant* to any Connected Persons provided that such recipients agree in writing to be bound by the terms of this confidentiality provision; and
 - (c) any information which is required to be disclosed by any applicable law or Statutory Requirement, the regulations of any stock exchange, any taxation authorities or by an order of a court or other tribunal of competent jurisdiction or any relevant regulatory body.
- 11.4 The *Consultant* shall procure that the Connected Persons comply with the provisions of this Clause 11 and is responsible to the *Employer* for any act or omission of any Connected Person in breach of such obligations.
- 11.5 The *Consultant* shall notify the *Employer* promptly if the *Consultant* becomes aware of any breach of confidence by a Connected Person and shall give the *Employer* all assistance the *Employer* may reasonably require in connection with any proceedings the *Employer* may

- bring or other steps the *Employer* may take against that Connected Person or any other person for such breach of confidence.
- 11.6 The *Consultant* acknowledges that damages would not be an adequate remedy for any breach of this Clause 11 by the *Consultant* and that (without prejudice to all other remedies to which the *Employer* may be entitled to as a matter of law) the *Employer* shall be entitled to any form of equitable relief to enforce the provisions of this Clause 11.
- 11.7 At the *Employer's* request and in any event upon the termination or expiry of the Contract, the *Consultant* shall promptly deliver to the *Employer* or destroy as the *Employer* may direct all documents and other materials in the possession, custody or control of the *Consultant* (or the relevant parts of such materials) that bear or incorporate the whole or any part of the confidential information and if instructed by the *Employer* in writing, remove all electronically held confidential information, including the purging of all disk-based confidential information and the reformatting of all disks.
12. In the event that the Main Works Contract or the employment of the Contractor thereunder is determined for any reason whatsoever including but not limited to the insolvency or winding-up of the Contractor (voluntary or otherwise), the *Consultant* shall without allowing any break or intermission to occur in the performance of his duties:
- (a) continue to observe and carry out his obligations under the Contract and this Deed;
 - (b) if so required by notice in writing from the *Employer* treat the *Employer* as client under the Contract to the exclusion of the Contractor whereupon all rights and obligations of the Contractor under the Contract shall thereafter be exercisable and performed by the *Employer*; and
 - (c) accept and enter into any deeds or other documents as are required to put into legal effect any further novation of the Contract reasonably required by the *Employer*.
- 13.1 The *Consultant* warrants and undertakes to the *Employer* that he will promptly inform the *Employer* of any default by the Contractor under the Contract and that he will not, without first giving the *Employer* at least 21 days' notice in writing, exercise any right he may have to terminate the Contract or to treat the same as having been repudiated by the Contractor or to suspend performance of his obligations under the Contract.
- 13.2 The *Consultant's* right to terminate the Contract or to treat it as having been repudiated or to suspend performance of his obligations thereunder shall cease if within the period of the aforesaid notice and subject to Clause 14 hereof the *Employer* shall have given notice in writing to the *Consultant* requiring the *Consultant* to accept the instructions of the *Employer* or its appointee to the exclusion of the Contractor in respect of the carrying out and Completion of the *services* upon the terms of the Contract.
14. The provisions of Clauses 12 and 13 hereof are conditional upon any notice given by the *Employer* pursuant thereto stating that the *Employer* or its appointee accepts liability for payment of the last unpaid invoice submitted by the *Consultant*. Upon the issue of any such notice by the *Employer*, the Contract shall continue in full force and effect as if no right of termination on the part of the *Consultant* had arisen and the *Consultant* shall be liable to the *Employer* or its appointee under the Contract in lieu of its liability to the Contractor. If any notice given by the *Employer* under Clauses 12 or 13 requires the *Consultant* to accept the instructions of the *Employer's* appointee, the *Employer* shall be liable to the *Consultant* as guarantor for the payment of all sums from time to time due to the *Consultant* from the *Employer's* appointee. For the avoidance of doubt neither the *Employer* nor his appointee shall be liable for any work carried out prior to the date of the *Employer's* notice.
15. The Contractor has agreed to be a party to this Deed for the purposes of acknowledging that the *Consultant* shall not be in breach of the Contract by complying with the obligations imposed on the *Consultant* by Clauses 12 or 13.
16. This Deed may be assigned by the *Employer* to any member of the TfL Group without limitation and otherwise to any other person on two occasions without the consent of the *Consultant* being required and the *Consultant* shall do all such acts, deeds and things as may be reasonably necessary to give effect to any such assignment. No further assignment shall be permitted without the consent of the *Consultant*.

17. The *Consultant* shall not be entitled to contend that any person to whom this Deed is assigned in accordance with Clause 16 is precluded from recovering under this Deed any loss incurred by such assignee resulting from any breach of this Deed (whenever happening) by reason that such person is an assignee and not a named promisee under this Deed.
18. The liability of the *Consultant* under this Deed shall cease 12 years following Completion of the whole of the *services*.
19. The rights and benefits conferred upon the *Employer* by this Deed are in addition to any other rights and remedies the *Employer* may have against the *Consultant* including without limitation any remedies in negligence.
20. The *Consultant* hereby covenants that if required by the *Employer* it will enter into further deeds of warranty with all and each of such persons who shall acquire or agree to acquire an interest in the whole or any part of the *services* [and/or the Infraco(s) and/or the PFI Contractor(s)]. Each such deed of warranty shall be in the same form mutatis mutandis as this Deed or in such substantially similar form as may reasonably be required by the *Employer*. **[Note: Include wording in brackets if the warranty relates to project for LUL otherwise delete]**
- 21.1 Notwithstanding any other provision of this Deed, the *Consultant* shall owe no greater obligations to the *Employer* than he owes to the Contractor under the Contract as if, in lieu of this Deed, the *Employer* was named in the Contract as joint employer with the Contractor, provided that the *Consultant* shall not be entitled to set-off or deduct from any sums payable to the *Employer* under this Deed any sums due or claimed as due by the *Consultant* from the Contractor.
- 21.2 The *Consultant* shall be entitled in any actions or proceedings brought by the *Employer* to rely on any limitation in the Contract and to raise the equivalent rights in defence of liability as he would have against the Contractor thereunder (but excluding set-offs and counterclaims) as if, in lieu of this Deed, the *Employer* was named in the Contract as joint employer with the Contractor.
22. Any notice to be given hereunder shall be deemed to be duly given if it is in writing and delivered by hand at or sent by registered post to the registered office or principle place of business in the United Kingdom for the time being of the party to be served and in the case of any such notice sent by registered post shall be deemed to have been received 48 hours after being posted.
- 23.1 Any dispute or difference arising out of or in connection with this Deed may be referred to adjudication in accordance with Clause 41 of the Framework Agreement which shall be deemed to be included in this Deed as if they were recited herein in full (with the necessary changes).
- 23.2 The Adjudicator's decision shall be binding on the parties until the dispute or difference is finally determined by the Courts in accordance with Clause 23.3.
- 23.3 The Courts of England and Wales shall have jurisdiction over any dispute or difference arising out of or in connection with this Deed. The Law of England and Wales shall be the proper law of this Deed.
24. Nothing in this Deed confers or is intended to confer on any third party any benefit or the right to enforce any term of this Deed pursuant to the Contracts (Rights of Third Parties) Act 1999.

25. **IN WITNESS** whereof this Deed has been executed and unconditionally delivered as a Deed by the parties the day and year first above written.

**THE COMMON/CORPORATE SEAL of
[EMPLOYER]**
was affixed to **THIS DEED**
in the presence of:

Signature of Director/Secretary

Print name of Director/Secretary

**[EXECUTED AND DELIVERED AS
A DEED by
[THE CONSULTANT]** acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

**[EXECUTED AND DELIVERED AS
A DEED by
[THE CONTRACTOR]** acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

SCHEDULE 11A
(Form of Warranty from Subconsultant to Employer)

THIS DEED is made on ● 200●

BETWEEN:

- (1) ● whose registered office is situate at ● ("the **Employer**" which expression shall include its successors and assigns);
- (2) ● whose registered office is situate at ● (the "**Subconsultant**"); and
- (3) ● whose registered office is situate at ● (the "**Consultant**").

WHEREAS:

- (A) The *Consultant* has entered into a call off contract dated ● (the "**Contract**") with the *Employer* for the carrying out of certain [**Services**] at ● (the "**services**").
- (B) The Subconsultant has been invited to design certain parts (the "**design works**") of the *services* and [has entered] [will shortly enter] into a deed of appointment with the *Consultant* (the "**Appointment**") for the *design works*.

NOW IT IS AGREED:

1. The following definitions shall apply in this Deed:

- (d) "Connected Persons" means of any of the Subconsultant's employees, directors, consultants, agents, subcontractors, subconsultants, suppliers, shareholders, professional advisers (including lawyers, auditors, financial advisers, accountants and technical consultants) or underwriters;
- (e) "Documents" means designs, drawings, models, plans, specifications, design details, photographs, brochures, reports, notes of meetings, CAD materials, manuals, instructions (including without limitation operating and maintenance instructions) and any other materials provided by the Subconsultant in connection with the *design works* (whether in existence or to be made);
- (f) ["Infraco(s)" means any and all of those contractors who have or will enter into contracts with [the *Employer*/London Underground Limited] under the public private partnership for the provision of infrastructure maintenance services on the Underground Network;] **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
- (g) "Minimum Records" means all records relating to the Subconsultant's operations, method statements, costs and expenses, subcontracts, claims relating to compensation events and financial arrangements and any document referred to therein or relating thereto and any similar records which the *Employer* may reasonably request;
- (h) ["PFI Contractor(s)" means any and all of those contractors who have or will enter into contracts with [the *Employer*/London Underground Limited] under the private finance initiative;] **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
- (i) "Prohibited Act" means:
 - (i) offering or agreeing to give to any servant, employee, officer or agent of the *Employer* or the *Consultant* any grant, gift or consideration of any kind as an inducement or reward for doing or not doing (or for having done or not having done) any act in relation to the obtaining or performance of the *Appointment* or any other contract with the *Employer* or the *Consultant* or for showing or not showing favour or disfavour to any person in relation to the *Appointment* or any other contract with the *Employer* or the *Consultant*;
 - (ii) entering into the *Appointment* or any other contract with the *Employer* or the *Consultant* in connection with which commission has been paid or has been agreed to be paid by the Subconsultant or on his behalf or to his knowledge unless, before the relevant contract or document is entered into, particulars of any such commission and the terms and conditions of any such contract or document for the payment thereof have been disclosed in writing to the *Employer* or the *Consultant*;

- (iii) committing any offence under the Prevention of Corruption Acts 1889-1916, under any law or legislation creating offences in respect of fraudulent acts, or at common law in respect of fraudulent acts in relation to the Appointment or any other contract with the *Employer* or the *Consultant*; or
 - (iv) defrauding or attempting to defraud the *Employer* or the *Consultant*;
- (j) ["Safety Breach" means a material breach of the Appointment caused by the gross incompetence or wilful default of the Subconsultant (or anyone employed or acting on behalf of the Subconsultant) or any of his agents which has materially affected the safe operation of the Underground Network or the *Employer's* employees, or the public or any other persons;] **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
 - (k) "TfL Group" means Transport for London ("TfL"), a statutory body set up by the Greater London Authority Act 1999 and all its subsidiaries and their subsidiaries (as defined in section 736 of the Companies Act 1985) from time to time together with Cross London Rail Links Limited (company number 04212657) and reference to any "member of the TfL Group" refers to TfL or any such subsidiary;
 - (l) ["Underground Network" means the stations and depots (wherever situate), assets, systems, track and other buildings, which are used in the maintenance and provision of the underground service known as the "London Underground".] **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
2. The Subconsultant warrants and undertakes to the *Employer* that;
- (m) he has exercised and will continue to exercise all the reasonable skill, care and diligence required by the Appointment in the performance of his duties to the *Consultant* under the Appointment; and
 - (n) he has complied with and will continue to comply with the terms of the Appointment.
- 3.
- 3.1 The Subconsultant warrants and undertakes to the *Employer* that to the extent the Subconsultant either is obliged to specify or approve products or materials for use or does so specify or approve, the Subconsultant does not specify or approve any products or materials which are generally known within the construction industry to be deleterious at the time of specification or approval in the particular circumstances in which they are to be used, or those identified as potentially hazardous in or not in conformity with:
- (a) the report entitled "Good Practice in the Selection of Construction Materials" (1997, by Tony Sheehan, Ove Arup & Partners, published by the British Council for Offices and the British Property Federation), or
 - (b) relevant International Standards, British Standards or European Standards or Codes of Practice and general good building and engineering practice, or
 - (c) any publications of the Building Research Establishment related to the specification of products or materials.
- 3.2 If in the performance of his duties under the Appointment, the Subconsultant becomes aware that he or any person has specified, approved or used any such products or materials, the Subconsultant immediately notifies the *Employer* in writing. This clause does not create any additional duty for the Subconsultant to inspect or check the work of others which is not required by the Appointment.

4. The Subconsultant further warrants and undertakes to the *Employer* that:
 - (a) subject to clause 2(a), the *design works* will on Completion satisfy all performance or output specifications and other requirements contained or referred to in the Appointment;
 - (b) he has exercised and will continue to exercise all reasonable skill, care and diligence in the selection of goods and materials for the *design works* in so far as such goods and materials have been or will be selected by or on behalf of the Subconsultant;
 - (c) the *design works* are integrated with the designs of the *Employer*, the *Consultant* and others [(and in particular the Infraco(s) and PFI Contractor(s))]; **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
 - (d) the *design works* will on Completion comply with the Statutory Requirements, all applicable law [and all relevant Standards]; **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
 - (e) he shall not commit a Prohibited Act [and/or Safety Breach]; and **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
 - (f) the *design works* will be carried out and completed timeously in accordance with the time constraints set out in the Appointment.

5. The Subconsultant warrants and undertakes to the *Employer* that he has maintained and will continue to maintain all insurances required to be maintained pursuant to the terms of the Appointment and that he has professional indemnity insurance with a limit of indemnity of not less than £[2/5 million] [in respect of each and every claim and in the aggregate] which may be made against the Subconsultant in relation to the *design works*. The Subconsultant shall maintain such professional indemnity insurance for a period of 12 years from Completion of the whole of the *services* provided that such insurance remains available at commercially reasonable rates and shall notify the *Employer* forthwith if such insurance ceases to be so available. When deciding whether such insurances are available at commercially reasonable rates, no account shall be taken of any increase in the premium or imposition of terms which arise as a result of the Subconsultant's insurance claims record.

6. As and when reasonably requested by the *Employer*, the Subconsultant shall produce for inspection documentary evidence that the insurances referred to in Clause 5 are being properly maintained and that payment has been made of the last premiums due in respect of such insurances.

7. To the extent that the intellectual property rights in any and all Documents have not already vested in the *Employer* or the *Consultant*, the Subconsultant grants to the *Employer* an irrevocable, non-exclusive, non-terminable, royalty-free licence to copy and make full use of any and all Documents and all amendments and additions to them and any works, designs or inventions of the Subconsultant incorporated or referred to in them for all purposes relating to the *services* including without limitation the construction, use, maintenance, repair, alteration, modification, enhancement and demolition of the Works provided always that the Subconsultant shall not be liable for the consequences of any use of the Documents as aforesaid for any other purpose. Such licence shall carry the right to grant sub-licences and shall be freely transferable to third parties without the prior consent of the Subconsultant.

8. The Subconsultant agrees:
 - (a) on request at any time to give the *Employer* or any persons authorised by the *Employer* access to the material referred to in Clause 7 and at the *Employer's* expense to provide copies of any such material; and
 - (b) at the Subconsultant's expense to provide the *Employer* with a set of all such material on Completion of the *design works*.

9. If called upon to do so by the *Employer*, the Subconsultant shall provide the *Employer* with such information relating to the *design works* as the *Employer* may reasonably require including without limitation copies of and extracts from Documents prepared or provided by the Subconsultant for the purposes of the *services* provided that neither the provision of such

- information nor any inspection of the *services* by the *Employer* or its agents nor the approval by the *Employer* or its agents of any material shall limit or discharge, or be deemed to limit or discharge the obligations of the Subconsultant under the Appointment or relieve the Subconsultant from any liability which he has in relation to the *design works*.
10. The Subconsultant warrants and undertakes to the *Employer* that he shall maintain and retain the Minimum Records for a minimum of twelve (12) years from Completion of the *services* with respect to all matters for which the Subconsultant is responsible under the Appointment. The Subconsultant further warrants and undertakes to the *Employer* that the Appointment contains open-book audit rights in favour of the *Employer* and its authorised representatives and that he shall undertake his obligations and exercise his rights under the Appointment on an open-book basis. The *Employer* and his authorised representatives may from time to time audit on an open-book basis and check and take copies of and extracts from any document or record of the Subconsultant including, without limitation the Minimum Records. The Subconsultant further warrants that it shall promptly provide all reasonable co-operation in relation to any audit or checking including, without limitation, granting access to premises, equipment, systems and senior personnel and making documents available. Without prejudice to the foregoing, the Subconsultant acknowledges and agrees that the *Employer* may audit and check any and all records as are necessary in order to monitor compliance with the Subconsultant's obligations under the Appointment with respect to Prohibited Acts [and Safety Breaches] at any time during performance of the Appointment and during the 12 years thereafter. **[Note: Include wording in square brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
11. The Subconsultant shall provide such assistance to the *Employer* as it may reasonably require in connection with the *design works*.
12. In the event that the Contract or the employment of the *Consultant* thereunder is determined for any reason whatsoever including but not limited to the insolvency or winding-up of the *Consultant* (voluntary or otherwise), the Subconsultant shall without allowing any break or intermission to occur in the performance of his duties:
- (a) continue to observe and carry out his obligations under the Appointment and this Deed;
 - (b) if so required by notice in writing from the *Employer* treat the *Employer* as client under the Appointment to the exclusion of the *Consultant* whereupon all rights and obligations of the *Consultant* under the Appointment shall thereafter be exercisable and performed by the *Employer*; and
 - (c) accept and enter into any deeds or other documents as are required to put into legal effect any further novation of the Appointment reasonably required by the *Employer*.
- 13.1 The Subconsultant warrants and undertakes to the *Employer* that he will promptly inform the *Employer* of any default by the *Consultant* under the Appointment and that he will not, without first giving the *Employer* at least 21 days' notice in writing, exercise any right he may have to terminate the Appointment or to treat the same as having been repudiated by the *Consultant* or to suspend performance of his obligations under the Appointment.
- 13.2 The Subconsultant's right to terminate the Appointment or to treat it as having been repudiated or to suspend performance of his obligations thereunder shall cease if within the period of the aforesaid notice and subject to Clause 14 hereof the *Employer* shall have given notice in writing to the Subconsultant requiring the Subconsultant to accept the instructions of the *Employer* or its appointee to the exclusion of the *Consultant* in respect of the carrying out and Completion of the *design works* upon the terms of the Appointment.
14. The provisions of Clauses 12 and 13 hereof are conditional upon any notice given by the *Employer* pursuant thereto stating that the *Employer* or its appointee accepts liability for payment of the last unpaid invoice submitted by the Subconsultant. Upon the issue of any such notice by the *Employer*, the Appointment shall continue in full force and effect as if no right of termination on the part of the Subconsultant had arisen and the Subconsultant shall be liable to the *Employer* or its appointee under the Appointment in lieu of its liability to the *Consultant*. If any notice given by the *Employer* under Clauses 12 or 13 requires the Subconsultant to accept the instructions of the *Employer's* appointee, the *Employer* shall be

- liable to the Subconsultant as guarantor for the payment of all sums from time to time due to the Subconsultant from the *Employer's* appointee. For the avoidance of doubt neither the *Employer* nor his appointee shall be liable for any work carried out prior to the date of the *Employer's* notice.
15. The *Consultant* has agreed to be a party to this Deed for the purposes of acknowledging that the Subconsultant shall not be in breach of the Appointment by complying with the obligations imposed on the Subconsultant by Clauses 12 or 13.
 16. This Deed may be assigned by the *Employer* to any member of the TfL Group without limitation and otherwise to any other person on two occasions without the consent of the Subconsultant being required and the Subconsultant shall do all such acts, deeds and things as may be reasonably necessary to give effect to any such assignment. No further assignment shall be permitted without the consent of the Subconsultant.
 17. The Subconsultant shall not be entitled to contend that any person to whom this Deed is assigned in accordance with Clause 16 is precluded from recovering under this Deed any loss incurred by such assignee resulting from any breach of this Deed (whenever happening) by reason that such person is an assignee and not a named promisee under this Deed.
 18. The liability of the Subconsultant under this Deed shall cease 12 years following Completion of the whole of the *services*.
 - 19.1 The Subconsultant shall owe no greater obligations to the *Employer* than he owes to the *Consultant* under the Appointment as if, in lieu of this Deed, the *Employer* had been a party to the Appointment as joint employer, provided that the Subconsultant shall not be entitled to set-off or deduct from any sums payable to the *Employer* under this Deed any sums due or claimed as due by the Subconsultant from the *Consultant*.
 - 19.2 The Subconsultant shall be entitled in any action or proceedings by the *Employer* to rely on any limitation in the Appointment and to raise the equivalent rights in defence of liability as he would have against the *Consultant* thereunder (but excluding set-offs and counterclaims) as if, in lieu of this Deed, the *Employer* had been a party to the Appointment as joint employer.
 20. The rights and benefits conferred upon the *Employer* by this Deed are in addition to any other rights and remedies the *Employer* may have against the Subconsultant including without limitation any remedies in negligence.
 21. The *Consultant* agrees that he will not take any steps which would prevent or hinder the *Employer* from exercising his rights under this Deed and confirms that the rights of the *Employer* in Clauses 12 and 13 override any obligations of the Subconsultant to the *Consultant* under the Appointment.
 22. Any notice to be given hereunder shall be deemed to be duly given if it is in writing and delivered by hand at or sent by registered post to the registered office or principal place of business in the United Kingdom for the time being of the party to be served and in the case of any such notice sent by registered post shall be deemed to have been received 48 hours after being posted.
 23. The Subconsultant hereby covenants that if required by the *Employer* it will enter into further deeds of warranty with all and each of such persons who shall acquire or agree to acquire an interest in the whole or any part of the *design works* [and/or the Infraco(s) and/or the PFI Contractor(s)]. Each such deed of warranty shall be in the same form mutatis mutandis as this Deed or in such substantially similar form as may reasonably be required by the *Employer*. **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
 - 24.1 Without limitation to Clause 2 above, the Subconsultant hereby warrants to the *Employer* that:
 - (a) except as provided under deeds of warranty required pursuant to the Appointment, it shall not, without the prior written approval of the *Employer*, at any time for any reason disclose to any person or publish or make any statement concerning the Appointment, this Deed or the Works (as defined in the Contract);
 - (b) he shall treat all information obtained under, arising from or in connection with the Appointment, this Deed and the Works as confidential, and that other than for the purpose of providing the *design works*, it shall not disclose any information or documents concerning the Appointment to any other person; and

- (c) he shall not, without the prior written consent of the *Employer*, disclose any information obtained by him concerning the *Employer* or the TfL Group to any other person.
- 24.2 The *Employer* may require as a precondition to the granting of such consent that any such third party provides a confidentiality undertaking in terms satisfactory to the *Employer*.
- 24.3 Clause 24.1 does not apply to the disclosure of:
- (a) any information which is already in the public domain at the time of its disclosure other than by breach of these provisions,
 - (b) any information disclosed by the Subconsultant to any Connected Persons provided that such recipients agree in writing to be bound by the terms of this confidentiality provision; and
 - (c) any information which is required to be disclosed by any applicable law or statutory requirement, the regulations of any stock exchange, any taxation authorities or by an order of a court or other tribunal of competent jurisdiction or any relevant regulatory body.
- 24.4 The Subconsultant shall procure that the Connected Persons comply with the provisions of this Clause 24 and is responsible to the *Employer* for any act or omission of any Connected Person in breach of such obligations.
- 24.5 The Subconsultant shall notify the *Employer* promptly if the Subconsultant becomes aware of any breach of confidence by a Connected Person and shall give the *Employer* all assistance the *Employer* may reasonably require in connection with any proceedings the *Employer* may bring or other steps the *Employer* may take against that Connected Person or any other person for such breach of confidence.
- 24.6 The Subconsultant acknowledges that damages would not be an adequate remedy for any breach of this Clause 24 by the Subconsultant and that (without prejudice to all other remedies to which the *Employer* may be entitled to as a matter of law) the *Employer* shall be entitled to any form of equitable relief to enforce the provisions of this Clause 24.
- 24.7 At the *Employer's* request and in any event upon the termination or expiry of the Appointment, the Subconsultant shall promptly deliver to the *Employer* or destroy as the *Employer* may direct all documents and other materials in the possession, custody or control of the Subconsultant (or the relevant parts of such materials) that bear or incorporate the whole or any part of the confidential information and if instructed by the *Employer* in writing, remove all electronically held confidential information, including the purging of all disk-based confidential information and the reformatting of all disks.
- 25.1 Any dispute or difference arising out of or in connection with this Deed may be referred to adjudication in accordance with Clause 41 of the Framework Agreement which shall be deemed to be included in this Deed as if they were recited herein in full (with the necessary changes).
- 25.2 The Adjudicator's decision shall be binding on the parties until the dispute or difference is finally determined by the Courts in accordance with Clause 25.3.
- 25.3 The Courts of England and Wales shall have jurisdiction over any dispute or difference arising out of or in connection with this Deed. The law of England and Wales shall be the proper law of this Deed.
26. Nothing in this Deed confers or is intended to confer on any third party any benefit or the right to enforce any term of this Deed pursuant to the Contracts (Rights of Third Parties) Act 1999.
27. **IN WITNESS** whereof this Deed has been executed and unconditionally delivered as a Deed by the parties the day and year first above written.

THE COMMON/CORPORATE SEAL of
[EMPLOYER]
was affixed to **THIS DEED**
in the presence of:

Signature of Director/Secretary

Print name of Director/Secretary

**[EXECUTED AND DELIVERED AS
A DEED** by
[THE SUBCONSULTANT] acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

**[EXECUTED AND DELIVERED AS
A DEED** by
[THE CONSULTANT] acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

Schedule 11B
(Form of Warranty from Subconsultant to Financier/P&T/Developer)

THIS DEED is made on ● 200●

BETWEEN:

- (1) ● whose registered office is ● (the "**Beneficiary**");
- (2) ● whose registered office is situate at ● (the "**Subconsultant**"); and
- (3) ● whose registered office is situate at ● (the "**Consultant**").

WHEREAS:

- (A) The *Consultant* has entered into a call off contract dated ● (the "**Contract**") with [EMPLOYER] whose registered office is at [ADDRESS] ("the *Employer*", which expression shall include its successors in title and assigns) for the carrying out of certain [**Services**] (the "**services**") at ● ("**the Works**").
- (B) The Subconsultant has entered into a deed of appointment dated ● (the "**Appointment**") with the *Consultant* for the design of certain parts of the *services* (the "**design works**") and into a collateral warranty dated ● (the "**Employer's Warranty**") with the *Employer*.
- (C) [The Beneficiary [intends to enter into] / [has entered into] an agreement to provide finance for the carrying out and completion of the *services*]. [The Beneficiary intends to enter into an agreement with the *Employer* under which it will agree that on or following Completion of the *services* it will [purchase] / [take a lease of] the whole or part of the *services*]. [The Beneficiary has an interest in the whole or part of the *services* as a developer and [intends to enter into] / [has entered into] an agreement with the *Employer* for [●]].

NOW IT IS AGREED:

Terms and expressions defined in the Appointment shall where the context so permits have the same meanings in this Deed. The following expressions have the meanings set out herein:

"Documents" means designs, drawings, models, plans, specifications, design details, photographs, brochures, reports, notes of meetings, CAD materials, manuals, instructions (including without limitation operating and maintenance instructions) and any other materials provided by the Subconsultant in connection with the *design works* (whether in existence or to be made);

["Infraco(s)" means any and all of those contractors who have or will enter into contracts with [the *Employer*/London Underground Limited] under the public private partnership for the provision of infrastructure maintenance services on the Underground Network;] **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**

["PFI Contractor(s)" means any and all of those contractors who have or will enter into contracts with [the *Employer*/London Underground Limited] under the private finance initiative;] **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**

"TfL Group" means Transport for London ("TfL"), a statutory body set up by the Greater London Authority Act 1999 and all its subsidiaries and their subsidiaries (as defined in section 736 of the Companies Act 1985) from time to time together with Cross London Rail Links Limited (company number 04212657) and reference to any "member of the TfL Group" refers to TfL or any such subsidiary;

["Underground Network" means the stations and depots (wherever situate), assets, systems, track and other buildings, which are used in the maintenance and provision of the underground service known as the "London Underground".] **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**

The Subconsultant warrants and undertakes to the Beneficiary that;

he has exercised and will continue to exercise all the reasonable skill, care and diligence required by the Appointment in the performance of his duties to the *Consultant* under the Appointment; and he has complied with and will continue to comply with the terms of the Appointment.

The Subconsultant warrants and undertakes to the Beneficiary that to the extent the Subconsultant either is obliged to specify or approve products or materials for use or does so specify or approve, the Subconsultant does not specify or approve any products or materials which are generally known within the construction industry to be deleterious at the time of specification or approval in the particular circumstances in which they are to be used, or those identified as potentially hazardous in or not in conformity with:

the report entitled "Good Practice in the Selection of Construction Materials" (1997, by Tony Sheehan, Ove Arup & Partners, published by the British Council for Offices and the British Property Federation), or relevant International Standards, British Standards or European Standards or Codes of Practice and general good building and engineering practice, or any publications of the Building Research Establishment related to the specification of products or materials.

If in the performance of his duties under the Appointment, the Subconsultant becomes aware that he or any person has specified, approved or used any such products or materials, the Subconsultant immediately notifies the Beneficiary in writing. This clause does not create any additional duty for the Subconsultant to inspect or check the work of others which is not required by the Appointment.

The Subconsultant further warrants and undertakes to the Beneficiary that:

Subject to clause 2(a), the *design works* will on Completion satisfy all performance or output specifications and other requirements contained or referred to in the Appointment; he has exercised and will continue to exercise all reasonable skill, care and diligence in the selection of goods and materials for the *design works* in so far as such goods and materials have been or will be selected by or on behalf of the Subconsultant; the *design works* are integrated with the designs of the *Consultant* and others [(and in particular the Infraco(s) and PFI Contractor(s)); **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]** the *design works* will on Completion comply with the Statutory Requirements, all applicable law [and all relevant Standards]; and **[Note: Include wording in brackets if the warranty relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]** the *design works* will be carried out and completed timeously in accordance with the time constraints set out in the Appointment.

The Subconsultant warrants and undertakes to the Beneficiary that he has maintained and will continue to maintain all insurances required to be maintained pursuant to the terms of the Appointment and the *Employer's Warranty* and that he has professional indemnity insurance with a limit of indemnity of not less than £[2/5 million] [in respect of each and every claim and in the aggregate] which may be made against the Subconsultant in relation to the *design works*. The Subconsultant shall maintain such professional indemnity insurance for a period of 12 years from Completion of the whole of the *services* provided that such insurance remains available at commercially reasonable rates and shall notify the Beneficiary forthwith if such insurance ceases to be available at commercially reasonable rates. When deciding whether such insurances are available at commercially reasonable rates, no account shall be taken of any increase in the premium or imposition of terms which arise as a result of the Subconsultant's insurance claims record.

As and when reasonably requested by the Beneficiary the Subconsultant shall produce for inspection documentary evidence that the insurances referred to in Clause 5 are being properly

maintained and that payment has been made of the last premiums due in respect of such insurances.

To the extent that the intellectual property rights in any and all Documents have not already vested in the *Employer* or the *Consultant*, the Subconsultant grants to the Beneficiary an irrevocable, non-exclusive, non-terminable, royalty-free licence to copy and make full use of any and all Documents and all amendments and additions to them and any works, designs or inventions of the Subconsultant incorporated or referred to in them for all purposes relating to the *services* including without limitation the construction, use, maintenance, repair, alteration, modification, enhancement and demolition of the Works provided always that the *Subconsultant* shall not be liable for the consequences of any use of the Documents as aforesaid for any other purpose. Such licence shall carry the right to grant sub-licences and shall be freely transferable to third parties without the prior consent of the Subconsultant.

The Subconsultant agrees:

on request at any time to give the Beneficiary or any persons authorised by the Beneficiary access to the material referred to in Clause 7 and at the Beneficiary's expense to provide copies of any such material; and at the Subconsultant's expense to provide the Beneficiary with a set of all such material on Completion of the *design works*.

If called upon to do so by the Beneficiary, the Subconsultant shall provide the Beneficiary with such information relating to the *design works* as the Beneficiary may reasonably require including without limitation copies of and extracts from Documents prepared or provided by the Subconsultant for the purposes of the *services* provided that neither the provision of such information nor any inspection of the *services* by the Beneficiary or its agents nor the approval by the Beneficiary or its agents of any material shall limit or discharge, or be deemed to limit or discharge the obligations of the Subconsultant under the Appointment or the *Employer's Warranty* or relieve the Subconsultant from any liability which he has in relation to the *design works*.

This Deed may be assigned by the Beneficiary to any member of the TfL Group without limitation and otherwise to any other person on two occasions without the consent of the Subconsultant being required and the Subconsultant shall do all such acts, deeds and things as may be reasonably necessary to give effect to any such assignment. No further assignment shall be permitted without the consent of the Subconsultant.

The Subconsultant shall not be entitled to contend that any person to whom this Deed is assigned in accordance with Clause 10 is precluded from recovering under this Deed any loss incurred by such assignee resulting from any breach of this Deed (whenever happening) by reason that such person is an assignee and not a named promisee under this Deed.

The liability of the Subconsultant under this Deed shall cease 12 years following Completion of the whole of the *services*.

The Subconsultant shall owe no greater obligations to the Beneficiary than he owes to the *Consultant* under the Appointment as if, in lieu of this Deed, the Beneficiary had been a party to the Appointment as joint employer, provided that the Subconsultant shall not be entitled to set-off or deduct from any sums payable to the Beneficiary under this Deed any sums due or claimed as due by the Subconsultant from the *Consultant*.

The Subconsultant shall be entitled in any action or proceedings by the Beneficiary to rely on any limitation in the Appointment and to raise the equivalent rights in defence of liability as he would have against the *Consultant* thereunder (but excluding set-offs and counterclaims) as if, in lieu of this Deed, the Beneficiary had been a party to the Appointment as joint employer.

The rights and benefits conferred upon the Beneficiary by this Deed are in addition to any other rights and remedies the Beneficiary may have against the Subconsultant including without limitation any remedies in negligence.

The *Consultant* agrees that he will not take any steps which would prevent or hinder the Beneficiary from exercising his rights under this Deed.

Any notice to be given hereunder shall be deemed to be duly given if it is in writing and delivered by hand at or sent by registered post to the registered office or principal place of business in the United Kingdom for the time being of the party to be served and in the case of any such notice sent by registered post shall be deemed to have been received 48 hours after being posted. Any

dispute or difference arising out of or in connection with this Deed may be referred to adjudication in accordance with Clause 41 of the Framework Agreement which shall be deemed to be included in this Deed as if they were recited herein in full (with the necessary changes).

The Adjudicator's decision shall be binding on the parties until the dispute or difference is finally determined by the Courts in accordance with Clause 17.3.

The Courts of England and Wales shall have jurisdiction over any dispute or difference arising out of or in connection with this Deed. The law of England and Wales shall be the proper law of this Deed.

Nothing in this Deed confers or is intended to confer on any third party any benefit or the right to enforce any term of this Deed pursuant to the Contracts (Rights of Third Parties) Act 1999.

IN WITNESS whereof this Deed has been executed and unconditionally delivered as a Deed by the parties the day and year first above written.

**[EXECUTED AND DELIVERED AS
A DEED by**

[THE BENEFICIARY] acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

**[EXECUTED AND DELIVERED AS
A DEED by**

[THE SUBCONSULTANT] acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

**[EXECUTED AND DELIVERED AS
A DEED by**

[THE CONSULTANT] acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary

SCHEDULE 12
(Form of Deed of Novation)

THIS AGREEMENT is made ● day of ● 201●

BETWEEN:

- (1) ● of [ADDRESS] (the "**Employer**" which expression includes its successors in title and assigns);
- (2) **[Member of TfL Group][GLA] [Infracore] [Contractor]** whose registered office is situated at **[INSERT REGISTERED ADDRESS OF REPLACEMENT EMPLOYER]** (the "**Replacement Employer**"); and
- (3) **[CONSULTANT]** whose registered office is at **[INSERT REGISTERED ADDRESS OF CONSULTANT]** (the "**Consultant**").

WHEREAS:

- (A) Pursuant to the terms of a framework agreement reference [] the Employer has appointed the Consultant to **[INSERT DESCRIPTION OF THE SERVICES]** (the "**Services**") by a call off contract dated ● (the "**Call Off Contract**").
- (B) [The Employer has appointed the Replacement Employer as a contractor pursuant to a building contract ("**the Contract**") to design and construct certain works as therein described ("**the Works**") [The Employer has entered into an agreement with the Replacement Employer pursuant to a contract ("**the Contract**") to design and construct certain works as therein described ("**the Works**") [The Employer has appointed the Replacement Employer as a design consultant pursuant to a contract ("**the Contract**") to carry out design in connection with certain works as therein described ("**the Works**")] **[Select or recite as appropriate].**
- (C) The Replacement Employer wishes to become the Employer pursuant to the Call Off Contract and the Employer wishes to be discharged from all its obligations under the Call Off Contract.

NOW IT IS HEREBY AGREED as follows:

1. NOVATION

- 1.1 The Employer as beneficial owner hereby assigns to the Replacement Employer its entire rights, benefits, liabilities and obligations under and pursuant to the Call Off Contract including but without limitation, its accrued rights, benefits, liabilities and obligations.
- 1.2 The Consultant releases and discharges the Employer from any and all obligations and liabilities owed to the Consultant under the Call Off Contract and accepts the liability of the Replacement Employer under the Call Off Contract in lieu of the liability of the Employer.
- 1.3 The Consultant undertakes to perform the Call Off Contract and to be bound by its terms in every way as if the Replacement Employer were, and had been from the inception, a party to the Call Off Contract in lieu of the Employer. The Replacement Employer agrees that it will not hereafter terminate the Consultant's engagement under the Call Off Contract without the prior written consent of the Employer, such consent not to be unreasonably withheld or delayed.
- 1.4 The Replacement Employer undertakes to perform the Call Off Contract and to be bound by its terms in every way as if the Replacement Employer were, and had been from the inception, a party to the Call Off Contract in lieu of the Employer.
- 1.5 The Consultant shall be liable for any loss, damage, cost or expense (including the cost of settling any action) incurred by the Replacement Employer arising from any act, omission or default of the Consultant (whether based in negligence or any other form of legal liability) in the performance of the Call Off Contract prior to the execution of this Agreement whether or not such act, omission or default would have caused the Employer to suffer any loss, damage, cost or expense, provided that the Consultant has no liability under this clause 1.5 which is greater or of longer duration than it would have pursuant to the Call Off Contract if the Replacement Employer had been a party to the Call Off Contract as joint employer.
- 1.6 The Consultant acknowledges that all fees and expenses properly due to the Consultant under the Call Off Contract up to the date of this Agreement have been paid by the Employer.

2. WARRANTY TO THE EMPLOYER

The Consultant hereby:

- (a) warrants to the Employer that it has performed and will continue to perform each and all of its obligations, duties and undertakings under and pursuant to the Call Off Contract as and when required by and in all respects in accordance with the Call Off Contract;
- (b) warrants to the Employer, without limitation to Clause 2(a) above, that it currently has and will maintain professional indemnity insurance as required by and in accordance with the Call Off Contract;
- (c) grants to the Employer, to the extent that the intellectual property rights in any and all designs, drawings, models, plans, specifications, design details, photographs, brochures, reports, notes of meetings, CAD materials and any other materials, manuals, instructions (including without limitation operating and maintenance instructions) and any other materials provided by the Consultant in the performance of the Call Off Contract (whether in existence or to be made) ("Documents") are not vested in the Employer or the Replacement Employer, an irrevocable, royalty-free, non-exclusive licence to copy and make full use of any and all Documents and all amendments and additions to them and any works, designs or inventions of the Consultant incorporated or referred to in them for all purposes relating to the Works including without limitation the construction, use, maintenance, repair, alteration, modification, enhancement or demolition of the Services and/or Works provided always that the Consultant shall not be liable for the consequences of any use of the Documents as aforesaid for any other purpose. Such licence shall carry the right to grant sub-licences and shall be transferable to third parties without the prior consent of the Consultant;
- (d) warrants to the Employer, without limitation to Clause 2(a) above, that it has, and at all times will, comply with the duties and obligations set out in Annex 1 of this Agreement; and
- (e) acknowledges that the liability of the Consultant shall not be released, diminished or in any other way affected by any independent enquiry into any relevant matter which may be made or carried out by or on behalf of the Employer nor by any act or omission of any party carrying out such enquiry whether or not such act or omission might give rise to an independent liability of such party to the Employer.

3. THIRD PARTIES

- 3.1 The Employer may give a written notice (a "Notice") to the Consultant at any time that it requires the Consultant to execute and deliver collateral warranty agreements in favour of all or any of the beneficiaries identified in Clause 100.1 of the Call Off Contract ("Warranties") in accordance with that Clause 100.1,

provided that:

- (a) no Notice shall be served on the Consultant more than 12 years from the date of practical completion of the Works; and
- (b) no Notice shall require the Consultant to execute a Warranty in favour of any beneficiary where the Consultant has already entered into a Warranty in favour of such beneficiary.

- 3.2 The Consultant shall execute and deliver to the Employer appropriate Warranties within 7 days of any Notice issued by the Employer pursuant to Clause 3.1.

- 3.3 The Consultant shall, upon execution of this Agreement, execute and deliver a deed or deeds of collateral warranty in the form required by the Call Off Contract in favour of the Employer.

3.4 The Consultant shall, within 21 days of each request made from time to time by the Employer, procure that any Subcontractor or Subconsultant appointed by the Consultant executes and delivers a deed of collateral warranty in the form required by the Call Off Contract in favour of the Employer and/or any of the beneficiaries identified therein.

4. **STEP-IN RIGHTS**

4.1 The Consultant agrees that in the event of the termination of the Contract by the Employer, the Consultant will, if so required by notice in writing given by the Employer accept the instructions of the Employer or its appointee to the exclusion of the Replacement Employer in respect of the Services and/or Works upon the terms and conditions of the Call Off Contract. The Replacement Employer acknowledges that the Consultant shall be entitled to rely on a notice given to the Consultant by the Employer under this Clause 4.1 as conclusive evidence for the purposes of this Agreement of this termination of the Contract by the Employer.

4.2 The Consultant further agrees that it will not without first giving the Employer not less than 21 days notice in writing exercise any right it may have to terminate the Call Off Contract or to treat the same as having been repudiated by the Replacement Employer or to discontinue the performance of any duties to be performed by the Consultant pursuant thereto. The Consultant's right to terminate the Call Off Contract with the Replacement Employer or treat the same as having been repudiated or discontinue performance shall cease if, within such period of notice, the Employer shall give notice in writing to the Consultant requiring the Consultant to accept the instructions of the Employer or its appointee to the exclusion of the Replacement Employer in respect of the Services and/or Works upon the terms and conditions of the Call Off Contract.

4.3 It shall be a condition of any notice given by the Employer under Clauses 4.1 or 4.2 that the Employer or its appointee accepts liability for payment of the sums payable to the Consultant under the Call Off Contract, including payment of any sums outstanding at the date of such notice. Upon the issue of any notice by the Employer under Clauses 4.1 or 4.2, the Call Off Contract shall continue in full force and effect as if no right of termination on the part of the Consultant had arisen and the Consultant shall be liable to the Employer or its appointee under the Call Off Contract in lieu of its liability to the Replacement Employer. If any notice given by the Employer under Clauses 4.1 or 4.2 requires the Consultant to accept the instructions of the Employer's appointee, the Employer shall be liable to the Consultant as guarantor for the payment of all sums from time to time due to the Consultant from the Employer's appointee.

4.4 The Replacement Employer acknowledges that the Consultant shall not be in breach of the Call Off Contract by complying with the obligations imposed on it by Clauses 4.1 and 4.2.

5. **SERVICES FOR THE EMPLOYER**

5.1 The Consultant agrees that, notwithstanding the novation of the Call Off Contract pursuant to this Agreement, it will perform the services ("Further Services") set out in Annex 2 to this Agreement for the Employer for the remuneration referred to in Annex 3 hereof.

5.2 The Consultant warrants to the Employer that:

- (a) it will perform the Further Services using the reasonable skill, care and diligence to be expected of an appropriately qualified **[insert profession]**¹ holding itself out as having the competence, experience and resources necessary for the performance of such services and in accordance with the terms set out in the Call Off Contract as if they were set out in this Agreement; and
- (b) it will have in place professional indemnity insurance on the terms set out in the Call Off Contract in respect of such Further Services.

¹ [To be completed prior to signing deed of novation]

6. **PROPER LAW AND JURISDICTION**

This Agreement and the rights and obligations of the parties hereto shall be governed and construed according to English Law. Any dispute shall be subject to the jurisdiction of the English Courts.

7. **CONTRACTS (RIGHTS OF THIRD PARTIES ACT 1999)**

Notwithstanding any other provision in this Agreement, nothing in this Agreement is intended to confer on any third person (save the Employer's successors in title or permitted assignees) any right to enforce any of the provisions of this Agreement which such person would not have had, but for the Contracts (Rights of Third Parties) Act 1999.

IN WITNESS whereof the parties hereto have executed this Agreement as a Deed the day and year first before written.

**THE COMMON/CORPORATE SEAL of
[EMPLOYER]**

was affixed to **THIS DEED**
in the presence of:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary
**[EXECUTED AND DELIVERED AS
A DEED by
[REPLACEMENT EMPLOYER]**

acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary]

**[EXECUTED AND DELIVERED AS
A DEED by
[CONSULTANT]**

acting by:

Signature of Director

Print name of Director

Signature of Director/Secretary

Print name of Director/Secretary]

ANNEX 1

(ADDITIONAL OBLIGATIONS OWED TO THE EMPLOYER)

8. The following expressions have the meanings set out herein:
- 8.1 "Connected Persons" means any and all of the Consultant's, directors, consultants, agents, Sub-contractors, contractors, suppliers, shareholders, professional advisers (including lawyers, auditors, financial advisers, accountants and technical consultants) or underwriters.
- 8.2 "Minimum Records" means all records relating to the Consultant's operations, method statements, costs and expenses, subcontracts, claims relating to compensation events and financial arrangements and any document referred to therein or relating thereto and any similar records which the *Employer* may reasonably request.
- 8.3 "Prohibited Act" means:
- (a) offering or agreeing to give to any servant, employee, officer or agent of the Employer or the Replacement Employer any grant, gift or consideration of any kind as an inducement or reward for doing or not doing (or for having done or not having done) any act in relation to the obtaining or performance of the Call Off Contract or any other contract with the Employer or the Replacement Employer or for showing or not showing favour or disfavour to any person in relation to the Call Off Contract or any other contract with the Employer or the Replacement Employer;
 - (b) entering into the Call Off Contract or any other contract with the Employer or the Replacement Employer in connection with which commission has been paid or has been agreed to be paid by the Consultant or on his behalf or to his knowledge unless, before the relevant contract or document is entered into, particulars of any such commission and the terms and conditions of any such contract or document for the payment thereof have been disclosed in writing to the Employer or the Replacement Employer;
 - (c) committing any offence under the Prevention of Corruption Acts 1889-1916, under any law or legislation creating offences in respect of fraudulent acts, or at common law in respect of fraudulent acts in relation to the Call Off Contract or any other contract with the Employer or the Replacement Employer; or
 - (d) defrauding or attempting to defraud the Employer or the Replacement Employer.
- 8.4 ["Safety Breach" means a material breach of the Call Off Contract caused by the gross incompetence or wilful default of the Consultant (or anyone employed or acting on behalf of the Consultant) or any of his agents which has materially affected the safe operation of the Underground Network or the Employer's employees, or the public or any other persons.] **[Note: Include wording in brackets if the novation relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**
- 8.5 "TfL Group" means Transport for London ("TfL"), a statutory body set up by the Greater London Authority Act 1999 and all its subsidiaries and their subsidiaries (as defined in section 736 of the Companies Act 1985) from time to time together with Cross London Rail Links Limited (company number 04212657) and reference to any "member of the TfL Group" refers to TfL or any such subsidiary.
- 8.6 ["Underground Network" means the stations and depots (wherever situate), assets, systems, track and other buildings, which are used in the maintenance and provision of the underground service known as the "London Underground".] **[Note: Include wording in brackets if the novation relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]**

9. CONFIDENTIALITY AND PUBLICITY

9.1 Without limitation to Clause 2 of this Agreement, the Consultant hereby warrants and undertakes to the Employer that:

- (a) except as provided under deeds of warranty required under clause 100.1 of the Call Off Contract, it shall not, without the prior written approval of the Employer, at any time for any reason disclose to any person or publish or make any statement concerning the Call Off Contract, this Agreement or the Works (as defined in the Call Off Contract);
- (b) it shall treat all information obtained under, arising from or in connection with the Call Off Contract, this Agreement and the Works as confidential, and that other than for the purpose of providing the Services, it shall not disclose any information or documents concerning the Call Off Contract to any other person; and
- (c) it shall not, without the prior written consent of the Employer, disclose any information obtained by it concerning the Employer or the TfL Group to any other person.

9.2 The Employer may require as a precondition to the granting of such consent that any such third party provides a confidentiality undertaking in terms satisfactory to the Employer.

9.3 Paragraph 2.1 above does not apply to the disclosure of:

- (a) any information which is already in the public domain at the time of its disclosure other than by breach of these provisions,
- (b) any information disclosed by the Consultant to any Connected Persons provided that such recipients agree in writing to be bound by the terms of this confidentiality provision; and
- (c) any information which is required to be disclosed by any applicable law or Statutory Requirement, the regulations of any stock exchange, any taxation authorities or by an order of a court or other tribunal of competent jurisdiction or any relevant regulatory body.

9.4 The Consultant shall procure that the Connected Persons comply with the provisions of this paragraph 2 and is responsible to the Employer for any act or omission of any Connected Person in breach of such obligations.

9.5 The Consultant shall notify the Employer promptly if the Consultant becomes aware of any breach of confidence by a Connected Person and shall give the Employer all assistance the Employer may reasonably require in connection with any proceedings the Employer may bring or other steps the Employer may take against that Connected Person or any other person for such breach of confidence.

9.6 The Consultant acknowledges that damages would not be an adequate remedy for any breach of this paragraph 2 by the Consultant and that (without prejudice to all other remedies to which the Employer may be entitled to as a matter of law) the Employer shall be entitled to any form of equitable relief to enforce the provisions of this paragraph 2.

9.7 At the Employer's request and in any event upon the termination or expiry of the Call Off Contract, the Consultant shall promptly deliver to the Employer or destroy as the Employer may direct all documents and other materials in the possession, custody or control of the Consultant (or the relevant parts of such materials) that bear or incorporate the whole or any part of the confidential information and if instructed by the Employer in writing, remove all electronically held confidential information, including the purging of all disk-based confidential information and the reformatting of all disks.

10. PROHIBITED ACTS AND SAFETY BREACHES

10.1 Without limitation to paragraph 2 of this Agreement, the Consultant hereby warrants and undertakes to the Employer that he shall not commit a Prohibited Act [and/or Safety Breach].

[Note: Include wording in brackets if the novation relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]

11. **MINIMUM RECORDS AND AUDITS**

- 11.1 Without limitation to paragraph 2 of this Agreement, the Consultant hereby warrants and undertakes to the Employer that that he shall maintain and retain the Minimum Records for a minimum of twelve (12) years from completion of the Works with respect to all matters for which the Consultant is responsible under the Call Off Contract. The Consultant further warrants and undertakes to the Employer that the Call Off Contract contains open-book audit rights in favour of the Employer and its authorised representatives and that he shall undertake his obligations and exercise his rights under the Call Off Contract on an open-book basis. The Employer and his authorised representatives may from time to time audit on an open-book basis and check and take copies of and extracts from any document or record of the Consultant including, without limitation the Minimum Records. The Consultant further warrants that it shall promptly provide all reasonable co-operation in relation to any audit or checking including, without limitation, granting access to premises, equipment, systems or senior personnel and making documents available. Without prejudice to the foregoing, the Consultant acknowledges and agrees that the Employer may audit and check any and all records as are necessary in order to monitor compliance with the Consultant's obligations under the Call Off Contract with respect to Prohibited Acts [and Safety Breaches] at any time during performance of the Call Off Contract and during the 12 years thereafter. ***[Note: Include wording in brackets if the novation relates to project for LUL/LUL Nominee BCV/SSL otherwise delete]***

SCHEDULE 13
(Supplier Performance)

Supplier Performance

Measuring the performance of its consultants is important to TfL. All call offs from the framework which are in excess of £100k in value will include a set of key performance indicators (KPI) which will be measured every quarter as a minimum.

TfL will also measure the performance of call off contracts which are less than £100k in value using a scoring of 1 (poor) to 5 (excellent).

The consultant's performance results are reported at Director level across TfL.

TfL expects good performance on all contracts. Where poor performance is identified a process for mitigation will be implemented. Likewise where there is evidence of good performance the supplier's work will be promoted across TfL. For the avoidance of doubt TfL reserves the right at its sole discretion not to utilise an Incentive Schedule as per Secondary option X20 when calling off from the Framework.

Call off contracts greater than £100k in value

A set of Key Performance Indicators (KPI) will be prepared by TfL and included within each call off contract. The KPI's will be produced against each of the 7 measures as indicated in appendix A of this schedule and as referenced within TfL's balanced scorecard. The KPI results will be collected every quarter as a minimum.

Call off contracts less than £100k in value

Each quarter TfL will collect data on the consultant's performance. Each call off will be scored from 1 to 5 using the scoring definition as indicated within table 1 below;

Table 1

Score	Scoring Definition
N/A	This activity is not applicable for this supplier
1	The supplier does not display any examples of good practice
2	The supplier displays some good practice but is generally poor in this area
3	The supplier is average/acceptable in this area
4	The supplier demonstrates good practice
5	The supplier excels in this element

If a specific call off contract is below £100k but deemed to be of high importance and risk to TfL, the project team in consultation with commercial have the option to include a set of KPI's within the "call off" contract.

Call off contracts for individuals filling a role in TfL on a temporary basis

TfL also has demand for individuals to fill roles within the organisation on a temporary basis. This could be typically for a period of between 3-6 months.

A very small number of these individuals will be on £750 a day or more. TfL has extremely high expectations from this small number of individuals working in the organisations, as a result their performance will also be measured as part of the quarterly survey using the 1 – 5 scoring matrix described within table 1 above.

The remaining individuals filling roles temporarily within TfL will not have their performance measured through the quarterly survey. If the individual is not performing he will be asked by the employing manager to leave the organisation.

To help these relationship and to align expectations, the employing manager will use the behavioural matrix as indicated within Appendix B to manage the day to day relationship.

Addressing poor performance and recognising good performance

As a minimum, TfL expects good performance from its consultants. The information on supplier performance will be communicated quarterly to directors across TfL.

The result of the survey will be published and made available to suppliers across TfL indicating the position of each supplier in the form of a league table.

If a Consultant obtains a score of less than 3 then this will form the basis for the production of a Supplier Action Plan, which will need to be discussed and approved by the TfL Framework manager.

The Consultant will then submit a “Supplier Action Plan” every four weeks which shall be monitored jointly by TfL and the Consultant.

Escalation route for poor performance

If the consultant has a poor score (1 or 2) on any contract, it is important that a speedy resolution is in place to remedy and address the poor performance.

The consultant’s proposal to resolve levels of poor performance through the Supplier Action Plan should be developed in consultation with TfL and provided to the TfL framework manager within 5 days of the poor performance being identified.

If the next quarterly survey identifies the project is still under performing this will be escalated to the Sponsors/ Directors for the relationship to agree next steps.

If the mitigation plan is unsuccessful, TfL’s Managing Director and the supplier’s CEO or business owner will intervene and meet with the Framework Manager to discuss and agree how to resolve the poor performance.

As a last resort, the consultant may be asked not to bid for future work under the framework until their performance issue is resolved, (The supplier would need to agree to this course of action in writing) or in extreme cases they may be removed from the framework.

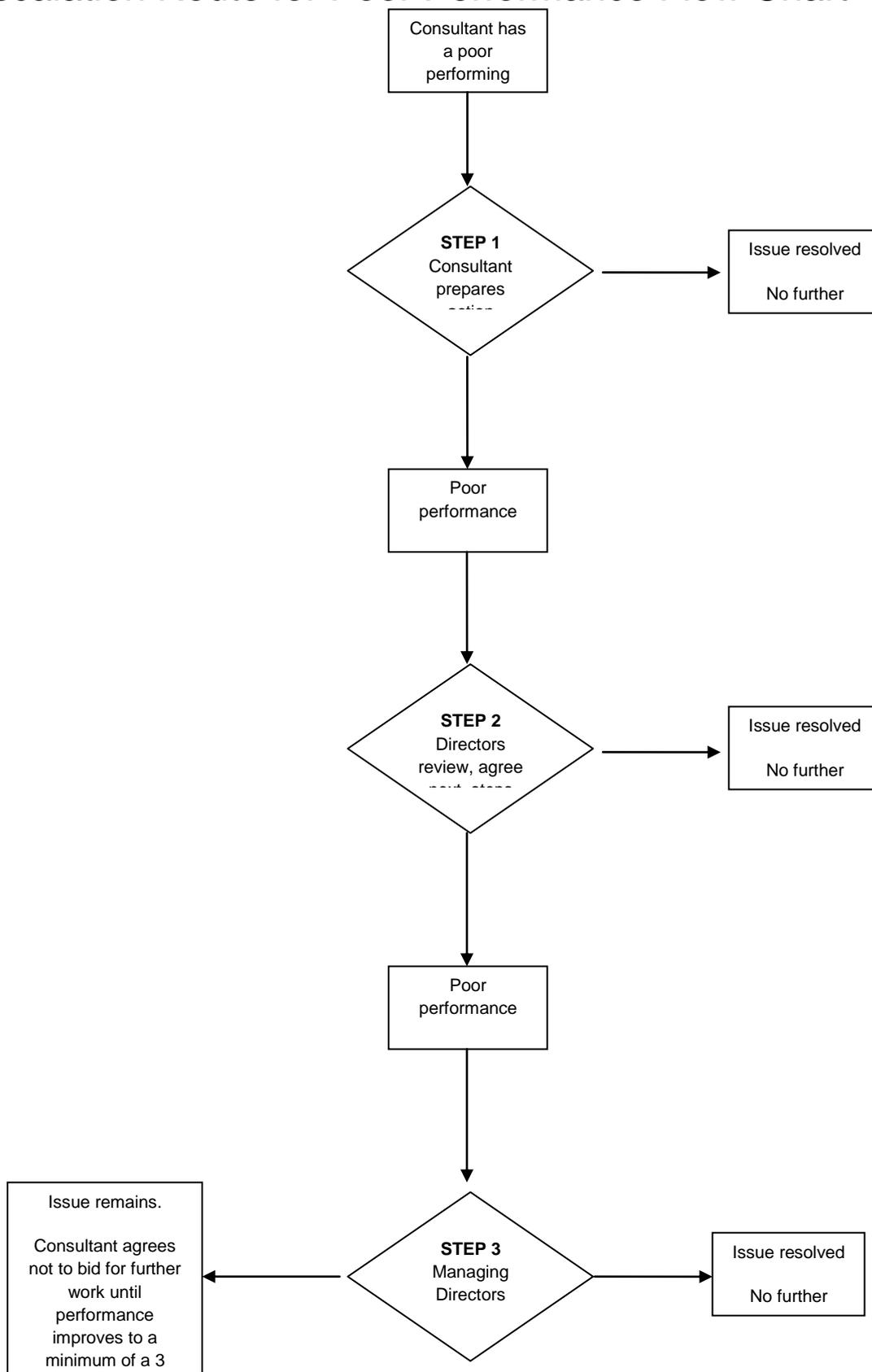
Promoting good performance in TfL

TfL expects good performance and encourages its consultants to excel.

The consultant, who is found to be the best performing in a quarter, will be rewarded with the opportunity to hold a workshop/presentation within TfL on Innovation.

The event will be facilitated and supported by TfL’s supplier relationship manager and attended by 8-10 senior managers from across TfL.

Escalation Route for Poor Performance Flow Chart



APPENDIX A

KEY ELEMENT	GUIDANCE FOR PREPARING KPI's	APPENDIX A
SAFETY & ENVIRONMENTAL	<ul style="list-style-type: none"> - Supplier undertakes regular training / awareness sessions for their employees on Health & Safety, Quality and Environment - Supplier has a 'Zero Harm' campaign internally to create a safety 'culture' (i.e. posters, desk drops, CBT, videos, spot-checks)? - Supplier employees demonstrate Safety and Environmental knowledge and practice it as appropriate in their work - Are there regular safety audits / risk assessment carried out by the supplier/ an authorised body on their sites? - Supplier preventative measures - after any kind of incident, is there a recognised and documented process the supplier has in place to ensure it does not re-occur? - Does the supplier have targets for recycling and wastage in place that they achieve on a regular basis? 	
RELIABILITY / RESILIENCE / QUALITY	<ul style="list-style-type: none"> - Supplier's ability to deliver at a good level over a sustained period - Supplier accreditations i.e. BS 9001 (or industry equivalent) - Supplier's attitude is 'can-do' and they flex to our evolving requirements, given the nature of our work is not always predictable - Supplier's delivery meets with customer / end user satisfaction - Any pre-delivery and post-delivery service / management of expectations by the supplier - Frequency of non-conformance / re-work due to errors or not meeting TfL's specification 	
CLOSURES / DISRUPTIONS / NETWORK CONGESTION	<ul style="list-style-type: none"> - Has the supplier caused any unplanned closures to a line / track / station / lift / escalator / platform etc in the quarter due to their error / lack of delivery / lack of planning / lack of understanding of the impacts their works would have on other utilities? - How good is the supplier at managing expectations of the works they undertake and the impact of these works on TfL and our customers? - If the supplier does cause any unplanned closures, how good are they at managing and mitigating the impact of it on TfL and our customers? 	
INNOVATION	<ul style="list-style-type: none"> - Does the supplier hold regular innovation workshops or meetings? - Does the supplier proactively come up with innovative new ideas or better ways of working for TfL? - Has the supplier implemented any innovative ideas / new ways of working with TfL? - Supplier receptivity to TfL innovative ideas - Supplier support on implementing ideas - Supplier proactive / willing to make necessary changes to existing processes/ procedures where it is clear they add no value anywhere or if they do not work for TfL - Process improvements achieved by value analysis with supplier - Savings generated from value analysis exercise undertaken with supplier - Supplier demonstrates a deep understanding of our business and industry and enhances our services to our customers 	
EFFICIENCY / VALUE FOR MONEY	<ul style="list-style-type: none"> - Ability to deliver within budget / contract price - Savings delivery against targets - Proactively delivering over and above the contract to generate value for TfL - doesn't have to be massive things, but can be small value-adding things (for example a supplier may proactively decide 'piggy-back' with a competitor on their common deliveries to save costs and carbon emissions and pass some of the savings on to TfL) 	
DELIVERY	<ul style="list-style-type: none"> - Delivery on or within schedule / milestones met - Ability to meet or exceed contractual obligations - Ability to plan and forecast resources and logistics to meet TfL specification - Supplier's competency and capability in their delivery - Supplier's management of their supply chain to deliver to TfL 	
RESPONSIBLE PROCUREMENT	<ul style="list-style-type: none"> - Supplier's willingness to drive RP initiatives - Supplier has dedicated resources in their organisation to establish RP firmly on their agenda - Supplier has set themselves RP targets and objectives - Supplier works with their peers and their supply chain to establish joint RP initiatives /share RP best practice - Supplier is working with TfL on establishing RP initiatives 	

APPENDIX B

	BEHAVIOURS				
TIL MUTUAL BEHAVIOURS FOR SUPPLIER RELATIONSHIPS	Collaborative 5	Aligned 4	Effective 3	Distant 2	Negative 1
SAFETY & ENVIRONMENTAL	Supplier senior management demonstrate a 'zero harm' culture by promoting HSE discussions at meetings, sharing HSE standards and best practices and collaborating to continually improve by facilitating joint HSE training sessions and knowledge - Supplierstaff proactively take ownership of ensuring their colleagues are informed and compliant with HSE standards and best practices and how these translate into activities relevant to their roles within the relationship - Supplierstaff exhibit a positive and responsible attitude to safety and environmental practices and are compliant with them at all times	Supplier senior management actively encourages their staff to exhibit safety and environmental practices by providing regular training sessions, running desk drop campaigns and having policies in place on HSE with annual targets etc. - Supplierstaff usually demonstrate compliance with safety and environmental good practices Supplier colleagues regularly collaborate with others to ensure they have a mutual understanding of the HSE activities each is doing	Supplier is working towards embedding a strong HSE compliant culture and this is led by senior management (i.e. Intranet, training sessions, desk drop, posters, internal comms etc.) Supplier staff usually demonstrate compliance to their own HSE standards and practices and share these as required with each other, communicating any updates or changes as necessary Supplier teams display willingness to engage on further safety and environmental training and awareness to improve.	Supplier senior management do not actively promote safety and environmental practices within the organisation, but a general awareness of HSE is communicated - TL / supplier staffs understanding and recognition of good safety and environmental practice is limited and / or they sometimes display non-compliant behaviour - Sharing and communication of changes to HSE requirements are infrequent and may be unclear	Supplier senior management do not appear to promote safety and environmental within their organisation - The understanding and demonstration of good safety and environmental practices and behaviours by staff is frequently poor and non-compliant - Little or no effort to communicate their organisation's HSE standards or changes is made to other colleagues or parties
RELIABILITY / QUALITY	Supplier's behaviour is consistent with its organisational values and their teams demonstrate honesty and promote trust by doing what they will when they say they will Supplier demonstrates flexibility in their work to their colleagues and are able to collaborate on and prioritise what is important in an ever-changing environment Supplier teams display reciprocal behaviour to their colleagues and other parties and maintain positive composites under pressure - Trustworthiness is evident in proactive sharing of necessary and relevant information without being asked and by taking ownership of issues / errors without apportioning blame, but emphasising the lessons to be learned - Constructive feedback is proactively solicited and acted upon	Supplier behaviours are consistent with their organisational values Supplier demonstrates flexibility in their work to their colleagues and are able to collaborate on and prioritise what is important - Trust is evident in ownership being taken of important issues and their quick resolution - Constructive feedback is sought, offered and is acted upon - Supplierstaff demonstrate ability to deliver under pressure	Supplier behaviours are usually consistent with their organisational values Supplier team shares required information with other parties and usually manages expectations accurately - Issues are dealt with in reasonable timeframes, occasionally clarity of issue and ownership may be disputed Supplier regularly asks for feedback and displays evidence of applying it - Accepts responsibility for delivery of strategic responsibility	Supplier behaviours are sometimes inconsistent with their organisational values - Issues are not always owned or resolved within reasonable timeframes due to disagreements about ownership / lack of understanding / clarity about what was needed - Feedback is sought sporadically and whilst it is sometimes acted upon, it is not always constructive when it is offered Supplier staff can sometimes display a defensive attitude under pressure	Supplier behaviours are not very consistent with their organisational values - Trust and flexibility are not evident, however frustration, defensiveness and aggression are frequently exhibited to the detriment of the relationship - Constructive feedback is not sought for, nor offered and there is little evidence it is acted upon if it is given - Team does not appear able to deliver under pressure and is perceived as unreliable
MINIMISING DISRUPTIONS	Supplier holds itself accountable for delivering tasks, responsibilities and targets Supplier staff often exceed targets and proactively seek to take ownership of disruption issues Supplier exhibits understanding of the industry, environment and restraints their colleagues and other parties have to work within and proactively suggests changes to help reduce disruptions, even if it is not in their line of responsibility and demonstrates willingness and receptivity to such suggestions if made to them - Supplierescalates issues when appropriate, but also takes responsibility and makes executive decisions where necessary to ensure disruptions are minimised	Supplier holds itself accountable for delivering tasks, responsibilities and targets Supplier exhibits understanding of the environment, industry and restraints their colleagues / other parties have to work within and may suggest changes to help reduce disruptions from time to time and demonstrates receptivity to such suggestions if made to them Supplier is not afraid to escalate issues in their organisation when appropriate to expedite resolution	Supplier usually demonstrates responsibility for their tasks and does not make excuses for any minor failures but holds themselves accountable and displays ability to learn from any issues Supplier staff exhibit empathy of the environment, industry and any restraints their colleagues / other parties work within - Ownership is usually demonstrated of issues to minimise delays - Accepts no responsibility for delivery of strategic priorities	Supplier takes responsibility for their tasks and sometimes misses, however not always the targets, which are sometimes missed, causing unnecessary disruption Supplier does not always display a clear understanding of the environment, industry and restraints that their colleagues / other parties work within and as a result this sometimes causes disruption and delay	Supplier does not deliver against all targets Supplier frequently disputes the ownership of tasks and responsibilities, which can result in disruption and delays to projects - May sometimes apportion blame mistakenly for their non-delivery of targets and fails to manage expectations and escalate issues to resolve them - Does not demonstrate understanding of the environment, industry and restraints other colleagues / parties have to work within
INNOVATION	Supplier shows the ability to spot opportunities for mutual benefit and often comes up with new, innovative ideas - Supplier is receptive to and often solicits other people's new ideas Supplier proactively analyses trends / MI to anticipate new opportunities to add mutual value Supplier proactively establishes innovation workshop/meetings and their staff lead and facilitate these Supplier exhibits sound decision-making on feasibility and reality of the adoption of new ideas or ways of working	Supplier recognises changing demands / requirements and is able to offer and is receptive to offering solutions Supplier is open to new ideas / ways of working and is willing to host / facilitate innovation workshops/meetings and progress and develop initiatives from them Supplier staff are active and positive participants of any such meetings or workshops	Supplier recognises changing demands / requirements and is receptive to offering solutions Supplier is open to new ideas / ways of working Supplier is willing to attend innovation workshops/meetings and progress and develop initiatives from them	Supplier is open to other ideas but can be reluctant to embrace change or new and different ways of working - Supplier willing to attend innovation workshops/meetings but their staff are not active participants	Supplier does not exhibit receptivity to, or offer new ideas or different ways of working to develop mutual value - TL supplier is very reluctant to embrace change Supplier makes minimal effort to attend or contribute to innovation meetings or workshops
DELIVERY	Supplier demonstrates an excellent understanding of the industry and market other parties / clients operate in and has the ability to anticipate what their colleagues / partners need / aspire to Supplier staff collaborate, plan and organise themselves to ensure that their colleagues / partners / clients have everything needed for successful delivery Supplier staff are prompt to respond to queries or concerns, and goes the extra mile to add value and continually works to improve delivery of wider organisation Supplier demonstrates a strong working ethic in their culture and displays initiative when undertaking tasks and activities - Supplierstaff are always professionally courteous, punctual to meetings and are respectful of other people's opinions Supplier staff display diligence in accurately documenting actions and meeting summaries or minutes, rarely forgetting actions and can juggle and deliver against conflicting and changing priorities	Supplier demonstrates a strong understanding of their colleagues / partners / clients industry Supplier staff work, plan and organise themselves to ensure that their colleagues / partners / clients have everything required for successful delivery Supplier staff respond to queries or concerns quickly and efficiently Supplier demonstrates a good working ethic in their culture and often displays initiative when undertaking tasks and activities Supplier staff are professionally courteous, are punctual to meetings and calls and respectful of other people's opinions Supplier staff display diligence in accurately documenting actions and meeting summaries/minutes	Supplierdemonstrates a good understanding of partners / clients industries and is usually able to deliver efficiently - Supplierstaff work and plan to ensure that clients / partners are able to deliver Supplier usually responds to queries or concerns Supplier demonstrates a good working ethic in their culture Supplier staff are professionally courteous, punctual and respectful of other people's opinions - Shares, promotes and seeks 'buy-in' to mission	Supplier demonstrates a limited understanding of partners / clients industries Supplier sometimes struggles to plan and organise themselves to enable delivery - Supplierstaff respond to most queries or concerns in a reasonable timeframe Supplier staff are sometimes late to meetings, or cancel meetings at short notice and are perceived as lacking in professional courtesy at times	Supplier does not demonstrate an understanding of partners / client industries - Supplier ignores obvious opportunities for business performance improvement Supplier is not able to demonstrate that they have the ability to plan and organise themselves to deliver as they often miss deadlines Supplier do not respond to queries or concerns raised in a timely manner Supplier staff frequently display a lack of professional courtesy to others (i.e. lateness, lack of planning, disrespectful of others opinions, etc.) - Fails to convince/engage with audiences to the detriment of delivery
VALUE FOR MONEY	Supplier staff proactively seek to eliminate waste and unnecessary cost from the supply chain and exhibit collaboration, empathy and transparency in doing so - Supplierteam demonstrate simplicity and fairness in their approach to agreeing financials and are well regarded by all who deal with them	Supplier displays an understanding of how their actions and decisions impact on other parties' profits, revenues and costs Supplier staff are active participants and collaborators in any initiatives to eliminate waste in their supply chain Supplier team demonstrate simplicity and fairness in their approach to agreeing financials and are well regarded by all who deal with them	Supplier team demonstrate simplicity and fairness in their approach to agreeing financials Supplier participates in some initiatives to reduce waste in their supply chain Supplier shows an understanding of how their actions impact on their own costs and those of other organisations	Supplier team are sometimes difficult in their approach to agreeing financials Supplier does not actively seek to eliminate hidden costs or waste from their supply chain Supplier sometimes displays a misunderstanding of how their actions and decisions impact on the costs, revenues and profits of their own organisation as well as other parties	Supplier is unable to gauge the impact of their financial decisions on themselves and other organisations Supplier staff often make financial decisions that are sub-optimal and overly complex and may be perceived as manipulative and difficult, resulting in a lack of trust with colleagues from other organisations Supplier has little or no evidence to support that they participate in or promote any waste reduction initiatives in their supply chain Supplier exhibits a lack of transparency / fairness / simplicity in their costing / pricing
RESPONSIBLE PROCUREMENT	Supplier staff display a conscientious outlook about promoting Responsible Procurement and what it means for their colleagues throughout their supply chain - Supplier regularly drives collaborative initiatives on Responsible Procurement with their peers to raise the profile of RP and to generate further developments on it within their supply chain	Supplier senior management demonstrate a commitment to procuring goods and services responsibly within their organisation and Tier 1 suppliers by internal comms, hosting meetings etc on the topic Supplier staff display a conscientious outlook about promoting Responsible Procurement Supplier regularly attends collaborative initiatives on Responsible Procurement with their peers to raise the profile of RP and to generate further developments on it within their supply chain	Supplier senior management demonstrate a commitment to procuring goods and services responsibly within their organisation Supplier sometimes attends collaborative initiatives on Responsible Procurement with their peers to raise the profile of RP and to generate further developments on it within their supply chain	Supplier senior management do not appear to promote Responsible Procurement within their own organisation Supplier staff sometimes display ignorance of RP as a topic and what it entails Supplier occasionally attends a meeting on Responsible Procurement but is not an active participant	Supplier senior management do not appear to promote Responsible Procurement within their own organisation at all Supplier staff display ignorance of RP as a topic and what it entails - Supplier does not attend any meetings or workshops on Responsible Procurement

SCHEDULE 14

Strategic Labour Needs and Training (SLNT)

1 Introduction

- 1.1 Without prejudice to the other provisions in this Agreement relating to Consultant Personnel, this Schedule sets out the Consultant's obligations in respect of:
- (A) supporting the TfL Group (and Third Parties nominated by the TfL Group) in the implementation of the Skills and Employment Strategy; and
 - (B) ensuring that the Consultant attracts, develops and retains Consultant Personnel with the skills necessary to:
 - (i) deliver the Services, throughout the Term.

- 1.2 In this Schedule, the following terms shall have the corresponding meanings:

“Apprentice”	means a member of Consultant Personnel who is registered as an apprentice or technician with an industry recognised body;
“Agreed SLNT Plan”	means the Consultant's strategic labour needs and training plan set out at Appendix 3 (<i>Initial/Agreed SLNT Plan</i>) to this Schedule, to be prepared in accordance with the SLNT Plan Template and Approved by TfL;
“Initial SLNT Plan”	means the initial strategic labour needs and training plan set out at Appendix 3 (<i>Initial/Agreed SLNT Plan</i>), submitted by the Consultant prior to the Effective Date and to be agreed between the Parties in accordance with clause 2 of this Schedule;
“Monthly SLNT Monitoring Report”	means the report to be prepared by the Consultant in the form set out at Appendix 5 (<i>Monthly SLNT Monitoring Report Template</i>) and submitted to TfL in accordance with the provisions of clause 5.1 of this Schedule;
“Relevant Employment Vacancy”	means an employment vacancy within the Consultant's organisation for a member of Consultant Personnel;
“Skills and Employment Strategy”	means the TfL Group's ten (10) year skills and employment strategy, as amended from time to time. A copy of the Skills and Employment Strategy dated March 2011 is provided at Appendix 1 (<i>Skills and Employment Strategy</i>) to this Schedule;
“SLNT Co-ordinator”	has the meaning set out in clause 3.1 of this Schedule;
“SLNT Infraction”	means any breach by the Consultant of any of its obligations under this Schedule;
“SLNT Output”	means the minimum number of Apprentice positions or equivalent to be delivered by the Consultant (either directly through its own personnel and the personnel of its Sub-Contractors) under this Agreement, as identified and agreed in the Agreed SLNT Plan;
“SLNT Plan Template”	means the template for the SLNT Plan set out at Appendix 2 (<i>SLNT Template</i>) to this Schedule, to be completed by the Consultant;
“Trainee”	means a member of Consultant Personnel who is registered as a trainee with an industry recognised body; and

2 Agreed SLNT Plan

- 2.1 Based on the Initial SLNT Plan, the Consultant shall:
- (A) further develop the Initial SLNT Plan to reflect the comments and requirements of TfL; and

- (B) submit a revised copy of the Initial SLNT Plan to TfL for Approval within twenty (20) Working Days of the Effective Date.
 - [(C) provide an Implementation Plan as contained in Appendix 4 of this Schedule based on the revised copy of the Initial SLNT Plan within forty (40) Working Days of the Effective Date;]
- 2.2 If the Initial SLNT Plan is:
- (A) Approved, it shall be adopted immediately and become the Agreed SLNT Plan; or
 - (B) not approved, the Consultant shall amend the Initial SLNT Plan and re-submit it to TfL for Approval within the time period agreed in writing between the Parties. If TfL does not approve the Initial SLNT Plan following its resubmission, the matters preventing such approval shall be resolved in accordance with the Dispute Resolution Procedure.
- 2.3 Without limiting any other provision of this Agreement, the Consultant shall:
- (A) comply with provisions of the Agreed SLNT Plan; and
 - (B) at no additional cost to TfL and subject to the provisions of clause 2.4 below, review and amend the Agreed SLNT Plan and Implementation Plan:
 - (1) three (3) Months prior to the Commencement Date and
 - (2) every twelve (12) Months following the Commencement Date or at other times requested by TfL, to reflect:
 - (a) Good Industry Practice;
 - (b) any changes to the nature of the Services
 - (c) any amendments proposed by TfL.
- 2.4 Any changes or amendments to the agreed SLNT Plan shall be subject to a Change Control Request Procedure and shall not be implemented until approved in writing by TfL.
- 2.5 In order to facilitate the efficient implementation of the Consultants SLNT requirements as contained in the Agreed SLNT Plan, TfL will also require the Consultant to prepare an Implementation Plan as contained in Appendix 4 of this Schedule. The Implementation plan
- (1) will need to be completed within three (3) Months prior to the Operational Commencement Date and an either be prepared after the Agreed SLNT Plan has been formed or in
- 3 SLNT Co-ordinator**
- 3.1 Within twenty (20) Working Days of the Effective Date, the Consultant shall nominate a member of Consultant Personnel with the necessary skills and authority to:
- (A) be responsible for the implementation and on-going development and maintenance of the Agreed SLNT Plan; and
 - (B) act as the single point of contact between TfL Personnel on all matters concerning the Agreed SLNT Plan,
- (the “**SLNT Co-ordinator**”).
- 3.2 The Parties shall add the SLNT Co-ordinator to a list of Key Personnel.
- 4 Community Relations**
- 4.1 The Consultant acknowledges and accepts that members of the TfL Group work closely with Third Party organisations to implement the Skills and Employment Strategy.
- 4.2 Accordingly, the Consultant shall:
- (A) **Not used**
 - (B) attend a minimum of two (2) events each year, at a time and location specified by TfL, to publicise employment and training opportunities arising from the provision of the Services.
- 5 Monitoring and Reporting**
- 5.1 Subject to clause 5.2 below, the Consultant shall provide TfL with a Monthly SLNT Monitoring Report by the Performance Indicator Report Date detailing the Consultant’s performance against the Agreed SLNT Plan.

- 5.2 Failure to provide TfL with a copy of the Monthly SLNT Monitoring Report within the timescales set out in clause 5.1 above shall constitute a failure to meet the Acceptable Service Level.
- 5.3 The Consultant shall ensure at all times that it complies with the requirements of the Data Protection Act 1998 (as may be amended) in the:
- (A) **Not used**
 - (B) collection and reporting of the information to TfL pursuant to clause 5.1 above.

6 SLNT Infractions

- 6.1 Failure to:
- (A) ensure that each SLNT Output for the monitoring period is delivered in accordance with Agreed SLNT Plan; and/or
 - (B) review the Agreed SLNT Plan in accordance with clause 2.3 of this Schedule (*Strategic Labour Needs and Training*),
- shall constitute a failure to meet the acceptable service levels.

7 SLNT Audit

- 7.1 TfL may from time to time undertake any audit or check of any and all information regarding the Consultant's compliance the provisions of this Schedule.
- 7.2 The Consultant shall maintain and retain records relating to the Agreed SLNT Plan and its compliance with the provisions of this Schedule for a minimum of 12 years.
- 7.3 TfL shall use reasonable endeavours to co-ordinate such audits and to manage the number, scope, timing and method of undertaking audits so as to ensure that the Consultant is not, without due cause, disrupted or delayed in the performance of the Consultant's obligations under this Agreement.
- 7.4 The Consultant shall promptly provide all reasonable co-operation in relation to any audit or check including, to the extent reasonably possible in each particular circumstance:
- (A) granting or procuring the grant of access to any:
 - (1) premises used in the Consultant's performance of this Agreement, whether the Consultant's own premises or otherwise;
 - (2) equipment (including all computer hardware and software and databases) used (whether exclusively or non-exclusively) in the performance of the Consultant's obligations under this Schedule 14, wherever situated and whether the Consultant's own equipment or otherwise; and
 - (B) complying with TfL's reasonable requests for access to senior personnel engaged in the Consultant's performance of this Agreement.

APPENDIX 1 TO SCHEDULE 14

Skills and Employment Strategy

A copy of the Skills and Employment Strategy can be obtained from:

<http://www.tfl.gov.uk/assets/downloads/corporate/skills-employment-strategy.pdf>

APPENDIX 2 TO SCHEDULE 14

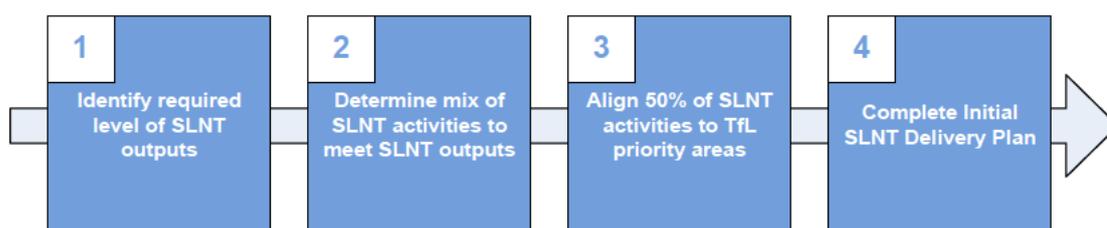
Note to Consultants: Appendix 2 of Schedule 14 is for reference only setting out the Consultants obligations should they be successfully awarded a Framework Agreement..

1. Principles of Strategic Labour Needs and Training (SLNT)

1.1 *Process Diagram*

1.1.1 To prepare the SLNT Delivery Plan, the *Consultant* should follow the process below, as outlined in Diagram 1:

Diagram 1:



1.2 *Determining Number of Required SLNT Outputs*

1.2.1 The *Consultant* can determine the number of required SLNT outputs based on the monetary value of aggregated call-off contracts:

Each £1 million in the aggregate under the suite of professional services framework agreements of call-off contract value for consultancy/ service call-off contracts 1 SLNT output

1.3 *Priority Areas*

1.3.1 To ensure the *Consultant's* SLNT outputs are aligned to the priorities in TfL's Skills and Employment Strategy, a **minimum of 50% of SLNT outputs must be from the Priority SLNT Activity Areas** (see Table 1 below).

1.4 *SLNT Activities*

1.4.1 The *Consultant* is able to select from a variety of SLNT activities to contribute towards their required SLNT outputs. SLNT activities, definitions and their output value, are detailed below in Table 1:

Table 1:

SLNT OUTPUT	DEFINITION	SLNT VALUE	PRIOR-ITY
Apprenticeships			
Apprentice Job Start	A new entrant who is recruited as an apprentice and enrolled on an approved Apprenticeship Framework. The apprentice must live within London. The apprentice can be any age from 16+.	1 SLNT Output 1 output for each year of the apprenticeship (e.g. a 3 year apprenticeship = 3 SLNT outputs)	✓
Workless Apprentice Job Start	A new entrant who is recruited as an apprentice and enrolled on an approved Apprenticeship Framework, and who was previously workless before starting the apprenticeship. The apprentice must live within London. The apprentice can be any age from 16+.	1 SLNT Output 1 output for each year of the apprenticeship (e.g. a 3 year apprenticeship = 3 SLNT outputs)	✓
Apprentice Start (existing staff)	An existing staff member who is enrolled onto an approved Apprenticeship Framework in order to up skill the workforce. The apprentice must live within London. The apprentice can be any age from 16+.	1 SLNT Output 1 output for each year of the apprenticeship (e.g. a 3 year apprenticeship = 3 SLNT outputs)	✓
Worklessness			
Workless Job Start	A new job start where the candidate was workless (economically inactive) prior to starting work. The candidate must live within London.	1 SLNT Output	✓
Workless Graduate Job Start	A graduate job start where the candidate was workless (economically inactive) prior to starting work. The candidate must live within London.	1 SLNT Output	✓
Educational/Career Support			
Placement Position	A position intended to enable an individual to learn, develop or enhance their knowledge and skills in an industry or job role by providing a short work experience placement. A placement is expected to last a minimum of 1 week. A placement position could be paid or unpaid and the individual must live within the London.	20 Days = 1 SLNT Output (e.g. 4 individuals each complete a 1 week placement: 4 x 5 days = 20 days = 1 output)	
School Engagement	Education activities that support schools and school students, by raising awareness of the educational and employment opportunities in the industry. This could include attending career fairs, school visits, ambassador programmes etc. Schools supported should be within London.	20 Days = 1 SLNT Output (e.g. 2 staff members attend 10 careers fairs: 2 x 10 days = 20 days = 1 output)	
Job Creation			
Job Start	A new job start for an individual who lives within London, recruited as a result of the contract. This could include a graduate job start (non workless).	1 SLNT Output	

1.5 **SLNT Definitions and Explanations**

1.5.1 The Consultant should be aware of the following definitions and explanations as set out in Table 2 below:

Table 2:

Apprenticeship Outputs ‘Carry Over’	Where an apprenticeship lasts for longer than 1 year, a <i>Consultant</i> can claim 1 SLNT output for each year the apprentice is enrolled onto, and completing, the apprenticeship framework. (E.g. 1 apprentice completing a 2 year apprenticeship would equate to 2 SLNT outputs over a 2 year period).
London	Defined as being within the boundaries of the Greater London Authority (GLA) and the 33 London Boroughs. <i>Consultants</i> are encouraged to recruit candidates who live within the vicinity of the project or works site.
Priority Activity Areas	SLNT Priority Activity Areas include Apprentice Starts, Workless Apprentice Starts, Apprentice Starts (existing staff), Workless Job Starts and Workless Graduate Starts (see Table 1).
Initial SLNT Delivery Plan	The bidder’s response to SLNT, to detail how they will meet the required SLNT outputs (see 3.1).
Worklessness	An individual is considered workless if they are ‘economically inactive’ and therefore not in paid employment or full time education. There is no minimum length of time the individual has to have been economically inactive to be considered workless. An individual who has moved into work from school, college or university is not considered workless.

1.6 **SLNT Exclusions**

- 1.6.1 Recognising that many products cannot be fully undertaken within a London or UK context, TfL is prepared to discount those elements from the overall value used to estimate the SLNT outputs.
- 1.6.2 Any exclusions will be balanced by the need to maximise SLNT outputs within a local London context and will only be agreed by TfL where it makes no sense to apply the SLNT requirements.
- 1.6.3 An example of this might be products that are manufactured outside of the UK. In such a case the value of the manufactured products would not be counted in determining the SLNT outputs, as compared to the installation and maintenance of those products which would be included.

1.7 **Accrual Method**

- 1.7.1 If the SLNT requirements are to be applied to a Framework Agreement, there is no initial value of work to be awarded. TfL will operate an accrual based system to transfer debits or credits associated with SLNT delivery over following years. For example, a *Consultant* undertaking SLNT activities in Year 1 can credit these activities into following years.

1.8 **Supply Chain/ Sub-consultants**

- 1.8.1 Where a *Consultant* will be using sub-consultants to deliver elements of any call-off contract, the *Consultant* will be required to apply the SLNT conditions/ requirements to these sub-consultants.
- 1.8.2 The *Consultant* will be responsible for ensuring monitoring and delivery of the SLNT requirements relating to their supply chain/ sub-consultants.

2 Supplier Skills Team

2.1 *TfL Supplier Skills Manager*

- 2.1.1 Working in partnership with the Greater London Authority (GLA), TfL has appointed a team of Supplier Skills Managers (SSM) to act as a central co-ordination point for TfL suppliers. This is to ensure that suppliers are able to access funding, work programmes, educational institutions etc in a controlled and co-ordinated manner.
- 2.1.2 After the commencement of the Framework Agreement the SSM and the *Consultant* must work together to understand their SLNT commitments as specified in the Initial SLNT Delivery Plan. During implementation the *Consultant* and SSM agree a final SLNT Delivery Plan to ensure SLNT Outputs are deliverable and take advantage of public sector funding and support.
- 2.1.3 Working to support the *Consultant*, the SSM will help to co-ordinate the various agencies and organisations (including Sector Skills councils, Department for Work & Pensions, National Apprenticeship Service, Skills Funding Agency etc) that offer skills or employment funding, into one integrated programme for the supplier.
- 2.1.4 The SSM is available to support the *Consultant* throughout the duration of the Framework Agreement.

2.2 *The Consultant's SLNT Coordinator*

- 2.2.1 It is a requirement of the Framework Agreement for the *Consultant* to appoint a SLNT Coordinator to manage the implementation of the SLNT Delivery Plan.
- 2.2.2 TfL expects the duties of the SLNT co-ordinator will include:
- Ensuring that the SLNT requirements are met
 - Acting as primary point of contact for TfL's Supplier Skills Manager
 - Managing sub-consultant compliance
 - Collection and presentation of the monitoring information including the monthly SLNT report
- 2.2.3 The role of the SLNT Co-ordinator is not required to be an exclusive appointment and may be combined with other duties.

3 Initial SLNT Delivery Plan

- 3.1 The Initial Strategic Labour Needs and Training Delivery Plan should be completed to demonstrate how the Consultant will deliver the required SLNT outputs. The plan is comprised of two components:
- a) Strategic Labour Needs and Training Activity Breakdown
 - b) Strategic Labour Needs and Training Method Statement

3.2 *SLNT Activity Breakdown*

- 3.2.1 The SLNT Activity Breakdown should show the Consultant's proposed SLNT activity to achieve the required SLNT outputs across the term of the Framework Agreements. The SLNT Activity Breakdown shall:
- b) Be prepared using the tables provided as Attachment 1.
 - c) Be constructed:

- In relation to the bidder's labour and/ or training plan
- In relation to each year of the Framework Agreements

3.3 SLNT Method Statement

3.3.1 The SLNT Method Statement should provide details of the SLNT activities the Consultant proposes to implement, as stated in the SLNT Activity Breakdown.

3.3.2 All elements of the questions should be addressed in the response.

4 SLNT: An Example

4.1 TfL has provided the following example to clarify the provisions of 1.1 – 1.8.2 above.

4.2 A supplier is bidding for a services contract with a value of £20 million over 4 years, and therefore has a requirement to delivery 20 SLNT outputs over the duration of the contract.

4.3 50% of the outputs must be from one of the Priority Activity Areas; this means that 10 of the SLNT outputs must be either an apprentice start, workless job start, workless graduate job start or apprentice start (existing staff). To meet these outputs the supplier has decided to:

- Recruit three new apprentices onto a two year apprenticeship framework; recruiting 2 apprentice in Year 1, and the next apprentice in Year 3 (3 apprentices x 2 years = 6 SLNT priority outputs)
- Recruit 4 new staff from a workless background (4 SLNT priority outputs)
- Deliver 5 educational engagement activities with local schools per year (5 days x 4 years = 20 days = 1 SLNT output)
- Offer 4 x 2 week placements to local unemployed young people across Year 2 and Year 3 (4 x 10 days = 40 days = 2 SLNT outputs)
- Recruit an extra 7 staff onto the contract (4 SLNT outputs).

6.4 The supplier's proposed SLNT Activity Breakdown is therefore set out in Table 3:

Table 3

SLNT Activity Breakdown - An Example								
SLNT Activity Area	Priority Output	Year 1	Year 2	Year 3	Year 4	Totals	Cross Check	
							SLNT Value	SLNT Totals
Apprenticeships								
- Apprentices Job Start (FTE)	Y	2	2	1	1	6	1	6
- Workless Apprentice Job Start (FTE)	Y					0	1	0
- Apprentice Start (Existing Staff)	Y					0	1	0
Worklessness								
- Workless Job Starts (FTE)		2	2			4	1	4
- Workless Graduate Job Start (FTE)						0	1	0
Educational/Career Support								
- Placement Positions (Days)			20	20		40	20	2
- School Engagement (Days)		5	5	5	5	20	20	1
Job Creation								
- Job Start (non-workless) (FTE)		3	2	2		7	1	7
						Total SLNT Activity		20
						Priority Activities		10

APPENDIX 3 TO SCHEDULE 14

Initial/Agreed SLNT Plan

NOTE TO Consultants: Consultants are required to submit their proposed Strategic Labour Needs and Training Plan in accordance with the requirements described in this Schedule 14. The Initial SLNT Plan will be inserted in this Appendix 3 on award of this Framework Agreement. When the content of such plan is approved by TfL such plan shall become the Agreed SLNT Plan.

APPENDIX 4 TO SCHEDULE 14

Implementation Plan

NOTE TO Consultants: *The implementation plan is required to be undertaken post contract award within the 3 month period specified in clause 2.3 1(B) of this schedule. The implementation plan is designed to provide additional information to TfL that allows the practical implementation of the bidders SLNT requirements, to be undertaken. The format of the implementation is appended below:*

SLNT Implementation Plan

1. Contact Information

TfL Contract

Supplier Skills Manager

Company
Contract Manager
TfL Stakeholder / SRM

SLNT Co-ordinator
Contact Phone Number
Contact Email

Reporting Requirements Quarterly / Monthly / Periodically

Report Period

Implementation Plan Review Date

2. Overview and Background

2.1 - Overview: Please provide an overview of the contract / project to which the SLNT requirements have been applied

[Empty text box for 2.1 - Overview]

2.2 - Method: Please outline how you will deliver your SLNT requirements with particular focus on TfL priority outputs

[Empty text box for 2.2 - Method]

2.3 - Forecasted Outputs: Please indicate in the table below forecasted SLNT outputs

	Worklessness			New Entrants			Trainee's		Current workforce		Educational Activities
	Apprenticeship (FTE)	Job Starts (FTE)	Placement Positions	Apprenticeship (FTE)	Job Starts (FTE)	Graduates (FTE)	Placement Positions (Nos)	Taster Positions (Nos)	Adult Apprenticeships	Workforce Skills (days)	
Previous Year											
March											
April											
May											
June											
July											
August											
September											
October											
November											
December											
January											
February											
March											
Annual Total	0	0	0	0	0	0	0	0	0	0	0
Future Years											
TOTAL	0	0	0	0	0	0	0	0	0	0	0

2.4 - Milestones: Please detail key milestones related to the delivery of your SLNT outputs

Milestone 1		Milestone 6	
Milestone 2		Milestone 7	
Milestone 3		Milestone 8	
Milestone 4		Milestone 9	
Milestone 5		Milestone 10	

2.5 - Partners: Please detail any partner organisations that will assist you in your SLNT delivery (Organisation and Key Contact)

Partner 1		Partner 6	
Partner 2		Partner 7	
Partner 3		Partner 8	
Partner 4		Partner 9	
Partner 5		Partner 10	

3. Risks: Please detail any risks and associated mitigation measures for the delivery of your SLNT requirements

	Risk	Likelihood	Risk Mitigation
1			
2			
3			
4			
5			

4. Communications: Please outline any planned SLNT communication, events or publications (internal and external) and how TfL will be notified

5. Monitoring: You are required to complete the two monitoring templates attached to this document (Sheets 1 and 2 of this document)

1. **SLNT Monitoring Form** - Outlines SLNT outputs for each reporting period
2. **Job Start Monitoring Form** - Outlines specific information for TfL Priority SLNT outputs

6. Sign Off:

Suppliers SLNT Co-ordinator (Name)	Signature	Date
------------------------------------	-----------	------

TfL Supplier Skills Manager (Name)	Signature	Date
------------------------------------	-----------	------

Implementation Plan Review Date	
---------------------------------	--

APPENDIX 5 TO SCHEDULE 14

Monthly SLNT Monitoring Report Template

Organisation	
TfL Contract / Project	
Date	
SLNT Reporting Period	

SLNT Category	TfL Priority	Numbers				Additional Detail / Information
		Annual Target	Annual Forecast	Outputs this Period	Outputs To Date	
Worklessness						
- Apprentices (FTE)	Y					
- Job Starts (FTE)	Y					
- Placement Positions (Nos)	Y					
New Entrants						
- Apprentices (FTE)	Y					
- Job Starts (FTE)						
- Graduates (FTE)						
Trainee's						
- Placement Positions (Nos)						
- Taster Positions (Nos)						
Current Workforce						
- Adult Apprentices (FTE)	Y					
- Workforce Skills (Days)						
Educational Activities (Days)						

Additional Information
Highlights
Issues / Concerns / Risks

Appendix 2

Technical Requirements Specification for the Saloon Design of 72TS (Bakerloo Line), 92TS (Central Line) and 92TS (Waterloo & City Line) (issue 3)

Programme: Rolling Stock Renewals, Central Line Improvement Programme, Bakerloo Line Life Extension
Project: PVEC3130 - Bakerloo line RVAR compliance, PVEC3149.250 - CLIP Saloon Design (formerly PVEC3131 - Central and W&C lines RVAR compliance and PVEC3026 - 92TS Floor repairs)

Document number: PVEC3131-TR-03-001

Technical Requirements Specification

for the

Saloon Design

of

72TS (Bakerloo Line)

92TS (Central Line)

92TS (Waterloo and City Line)

Prepared by

Prepared by

Approved by

Document History

Revision	Date	Summary of changes
Issue 0.1	19/05/2016	First draft
Issue 1.0	01/06/2016	First Issue, for Internal Review
Issue 2.0	08/07/2016	Second Issue, for Invitation to Tender
Issue 3.0	09/12/2016	Updated to reflect minor changes to scope for Contract Award

SUMMARY OF CHANGES

Categories are as follows:

- A - Additional data or information
- C - Correction of requirement
- N - New requirement
- R - Change to requirement
- T - Text or formatting change (no change to requirement)
- D - Requirement deleted

FROM ISSUE 2.0

Section / Requirement	Change	Description	Date
Page 1	T	Project numbers and titles updated.	09/12/16
3	A	Definitions for 'prototype modifications' and 'production modifications' added.	09/12/16
4.3.1 (e)	D	The physical integration of LED lighting is removed from the scope of design for 72TS. LED lighting installation will be installed on 72TS independently and in advance of the Saloon Design project.	09/12/16
4.4.2	R	Additional scope to provide an additional train set of prototype components added.	09/12/16
5.1.2	D	LED lighting integration removed from the workstream matrix for 72TS above waistrail.	09/12/16
6.2.1	A	Updated section to reflect the latest dates for PIS procurement.	09/12/16
6.2.3	R	The replacement destination display for 92TS (Central), part of the PIS, now requires physical integration.	09/12/16
6.2.4	R	PIS costed options removed. Replaced with statement that visual displays could either be scrolling text displays or advertising-sized screens.	09/12/16
6.4	R	72TS removed from title.	09/12/16

6.4.1	A	Additional information around LED lighting integration for 92TS added.	09/12/16
6.6.1	A	Additional interface added: 72TS (LED Lighting).	09/12/16
8.1 –Req. ID 2156	T	Defined term 'prototype modifications' added.	09/12/16
8.1 –Req. ID 2200	N	Additional scope to provide and additional train set of components for 'prototype modifications' added.	09/12/16
8.3 – Req. ID 2165	A	Note on Interface Definition Documents to be agreed with the suppliers of all interfacing equipment added.	09/12/16
9.1 – Req. ID 2167	T	Capitalise 'it is'.	09/12/16
9.1 – Req. ID 2168	T	Change 'ambiance' to 'ambience'.	09/12/16
10.10.5 – Req. ID 1823	R	Requirement updated to cover 92TS (W&C) only. Requirement no longer applicable to 72TS.	09/12/16
18	T	Header updated for document consistency	09/12/16
6.6.2 (d)	D	Clause deleted. Project to reinstate 100kph running in open sections has now been cancelled.	09/12/16
6.6.2 (c)	A	Additional detail around the Hainault Woodford shuttle added.	09/12/16

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1. THIS DOCUMENT

1.1 Purpose

- 1.1.1 The purpose of this document is to specify the technical requirements applicable to the design and prototyping of saloon (and minor cab) 'modifications' on 72TS (Bakerloo Line), 92TS (Central Line) and 92TS (Waterloo and City Line, or W&C).
- 1.1.2 This document will refer to the 1972 Tube Stock fleet that runs on the Bakerloo Line as '72TS'.
- 1.1.3 This document will refer to the 1992 Tube Stock sub-fleet that runs on the Central Line as '92TS (Central)'.
- 1.1.4 This document will refer to the 1992 Tube Stock sub-fleet that runs on the Waterloo and City Line as '92TS (W&C)'.
- 1.1.5 This document is referred to as 'the TRS' or 'Saloon Design TRS'.
- 1.1.6 The work conducted as a result of this TRS is referred to as the 'Saloon Design project'.

1.2 Document structure and presented information

- 1.2.1 Assumptions, Dependencies and Caveats (ADCs) and Requirements are all assigned IDs. IDs are unique within the group they belong, but not between groups.
- 1.2.2 Each ID shall be referenced using the prefix: 'ADC' or 'Req'.
- 1.2.3 IDs are presented to the right of the ADC or requirement and in italics.
- 1.2.4 For each requirement, there are tick-boxes provided to state applicability for each stock. It is also stated in the requirement for clarity, or in the title of a section.
- 1.2.5 Technical requirements are made up of:
- General requirements, detailed in Section 8
 - Feasibility investigation requirements (92TS Central), detailed in Section 9
 - Functional requirements, detailed in Section 10
 - Design principles requirements, detailed in Section 11
- 1.2.6 Each requirement is displayed in the following format, displaying the requirement text, the Req ID, and the applicability of the requirement to the three fleets.

EXAMPLE:

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

Requirement text shall follow headings and sub-headings, with its requirement ID adjacent to it on the right. When quoting this ID, the prefix 'Req' shall be used.

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- 1.2.7 Requirements or ADCs may include notes to provide additional information to aid understanding but do not form part of the requirement. These are shown using '**Note:**'

1.2.8 In the feasibility investigation requirements, a similar format is adopted but with the applicability to which feasibility option shown instead of fleet; they are all only applicable to 92TS (Central).

1.2.9 Appendices containing additional information are also provided:

- Appendix A provides additional information relating to the formation of each fleet, operating environment, users and other background information
- Appendix B details additional requirements applicable when conducting structural analysis, designing line replaceable units and for the replacement 'floor covering system' specification
- Appendix C covers previous work related to the scope of this TRS
- Appendix D contains a matrix of the design acceptance products as described in Section 12

1.3 Clarifications, contradictions and concessions

1.3.1 If clarifications are required, please request from the 'LU Engineer'.

1.3.2 If there are any contradictions, please request clarification from the 'LU Engineer'.

1.3.3 If a concession is required against a requirement or any part of the TRS, please contact the 'LU Engineer'. It is likely that detailed justification will be required to grant a concession.

1.3.4 In all cases, if required, this TRS will be updated to provide clarification.

2. ACRONYMS AND ABBREVIATIONS

2.1.1 The following acronyms and abbreviations are used in this TRS (that are not defined in Section 3, Definitions).

Abbreviation	Definition
72TS	1972 Tube Stock
92TS	1992 Tube Stock
ADC	Assumptions, Dependencies and Caveats
CCTV	Closed circuit television
ITT	Invitation to Tender
LED	Light emitting diode
LU, LUL	London Underground or London Underground Limited
MACS	Minimum Acceptable Condition Schedule
NCS	Natural Colour System
RVAR	Rail Vehicle Accessibility (Non-Interoperable Railways) Regulations
TRS	Technical Requirements Specification.
W&C	Waterloo and City

3. DEFINITIONS

3.1.1 The following terms are defined as shown below when used within this TRS with inverted commas, for example: 'Corporate Red'.

Term	Abbrev.	Definition
Acton TMU facility		London Underground's Railway Engineering Works in Acton, London where rail vehicle modification and overhaul works take place.
advert panel lighting		The fluorescent lighting positioned in the aperture above the advert panels and high level air vents on 'unmodified' 92TS trains
casualty maintenance		Maintenance or repairs that occur outside of 'routine maintenance' activities.
Corporate Red		The colour named "Corporate Red" in the latest issue of the TfL colour standard, S 1085-Y80R in the Natural Colour System (NCS). Note: The TfL colour standard is located at: http://content.tfl.gov.uk/tfl-colour-standard.pdf .
coated surfaces		Includes painted, powder coated, naturally finished or any other surface material finish used on structures, panels, fixtures and fittings on the interior of the train. This does not include glass or flooring materials.
crush laden		The increased train mass (over the 'tare' condition) resulting from: (a) Any other authorised person accompanying the 'train operator', for whom accommodation has been provided. (b) Passengers occupying all fixed seats (c) Passengers standing in the vestibule areas of the saloon, at the rate of 8 per m ² (d) Passengers standing in aisles greater than 800 mm wide, at the rate of 6 per m ² All persons are taken to weigh 75kg, including luggage.
design life		The specified life for which all functionality is available as specified in the requirements.
designer		The company contracted by the 'purchaser' to complete the Saloon Design project.

door system	<p>Means of permitting and denying access through doorways.</p> <p>Note: 'Door system' includes all of the following elements:</p> <ul style="list-style-type: none">(a) Door leaves(b) Door guidance system(c) Door open and close controls, circuits and equipment(d) Passenger dragging detection system(e) Door closed interlock detection mechanism (door interlocks)(f) Door lock and lock engaged detection mechanism(g) Door actuator and drive mechanism(h) Door actuator control equipment(i) Door locking mechanism(j) Trapped item release mechanism(k) Door obstacle detection system(l) Door condition monitoring system
doorway handrails	<p>Handrails fitted inside the saloon on either side of every double doorway, and on the draughtscreen side of single doorways (excluding R/S doors).</p>
exposed surfaces	<p>Surfaces that are exposed to 'passengers', or which may be exposed to 'passengers' through wear during the 'design life'.</p> <p>Note: 'Exposed surfaces' include, but are not limited to:</p> <ul style="list-style-type: none">(a) Floor surfaces(b) Wall and ceiling panels(c) Glazing(d) Handrails
first line maintenance	<p>Maintenance which is conducted by 'maintenance staff' at depots. It includes 'routine maintenance' and 'casualty maintenance'.</p>
fixed interface	<p>Physical joint between components which is designed to be left undisturbed by maintenance tasks.</p>
floor covering	<p>Product prefabricated in roll or tile form, which can be used to cover floors from wall to wall.</p> <p>Note: See BS EN 12466:1998 Resilient floor coverings - Vocabulary</p>

floor covering system		All components required to achieve the flooring requirements of this TRS, including: (a) Floor covering material (b) Adhesive or bonding agent to attach the covering to the sub-floor (including any primer or surface preparation materials) (c) Joint filler / sealant or system to join adjacent floor coverings (d) Edge coving plus bonding system and sealant where floor covering abuts seat bases, walls, stand-back pillars and sill plates
floor surfaces		The parts of a floor system exposed to passengers, including those parts which may be exposed to passengers through wear. Note: This includes the floor covering, sill plates, threshold strips, coving and retention strips.
fully laden		The increased train mass (over 'tare' condition) resulting from: (a) Any other authorised person accompanying the operator, for whom accommodation has been provided (b) Passengers occupying all fixed seats (c) Passengers standing in the vestibule areas of the saloon, at the rate of 5.6 per m ² (d) Passengers standing in aisles greater than 800 mm wide, at the rate of 4.2 per m ² All persons are taken to weight 75 kg, including luggage.
gangway		The part of the 'saloon' that allows passengers to move from one end of the car to the other. Note: 'Gangways' run through 'vestibules' and 'seating areas'.
grab pole		A type of handrail, specifically mounted vertically.
handrail		The customer facing component of the handrail assembly, designed to be held by the passenger. Handrails include 'grab poles'.
handrail assembly		The handrail and its attachments, fastenings and welds up to and including the carbody structure.
handrim-drive wheelchair	HDW	Manual wheelchair designed to be propelled and steered using handrims.

intrusive maintenance		Any maintenance work other than visual inspection. Note: Visual inspections that require removal of components to facilitate the said inspections are classified as 'intrusive maintenance'.
lateral		parallel to the width of the train
LED lighting		Light fittings to provide saloon lighting that use LED technology.
light reflectance value	LRV	The amount of light reflected by a surface, measured in accordance with BS 8493.
line replaceable unit	LRU	A modular component that is designed to be replaced quickly in an operational environment to reduce maintenance downtime and/or improve access.
litter		Items left lying in an open or public place, whether intentionally or not. Note: Litter commonly encountered on the London Underground railway includes, but is not limited to newspapers, batteries, pens, plastic bags, plastic bottles, plastic bottle caps, drinks cans, food containers, including polystyrene items and metallic foil, coins, mobile phones, hairclips, buttons, paper tickets, plastic cards, such as Oyster cards, credit cards and loyalty cards.
longitudinal		parallel to the length of the train
LU Engineer		The person responsible for the engineering of the Saloon Design, also known as the Project Engineer (within London Underground).
maintenance staff		Staff who perform routine, casualty and intrusive maintenance.
modifications		All components modified as a result of the Saloon Design project, specified by this TRS. This includes the physical integration of 'supplied equipment' and repairs.
modified handrails		Any change to the design or arrangement of any part of the 'handrail assemblies' on the 'existing train' excluding changes limited to handrail colour only.
modified train/unit/car		Any train/unit/car of 72TS, 92TS (Central) or 92TS (W&C) fleets modified by the Saloon Design project.

moveable interface		Physical joint between components which is designed to be disturbed at least once during its design life.
passenger doorway		Doorway in the side of the car intended for use by passengers. Note: therefore, does not include R and S doors
passenger environment		Aspects of rolling stock with which passengers interact, including visually, aurally, tactilely and olfactorily.
passenger information system	PIS	A system that allows audio and visual communications automatically into the saloon, specifically journey information and allows audio communications from: (a) the 'train operator' to the saloon and other cabs (b) the line controller to the saloon and cab
passenger seats		All seats provided within the saloon including fixed seats, priority seats and perch seats.
passengers		Those on the train for the purposes of travel.
priority seats		Those passenger seats that are accompanied by signage to inform that it is prioritised for use by disabled, pregnant or elderly persons.
production modifications		'Modifications' in accordance with the products submitted and accepted at the Production Readiness Review stage.
prototype modifications		'Modifications' in accordance with the products submitted and accepted at the Prototype Design Review stage.
purchaser		The company who employs the 'designer' to complete the Saloon Design project. Also known as London Underground.
redundant equipment		The equipment that is made redundant by the installation of the 'supplied equipment'. Equipment deemed 'redundant equipment' shall be agreed with the 'LU Engineer'.
reference population		The user population spanning the fifth percentile British female to the ninety-fifth percentile British male, as defined by "Peoplesize 2008 Version 2.02".
reference wheelchair		An occupied wheelchair, the dimensions of the chair and occupant as shown in diagram A of RVAR.

routine maintenance	Preventative maintenance and/or inspection tasks that are carried out on the basis of either mileage covered or duration, irrespective of any failure of the equipment.
saloon	The whole of the passenger space inside the train, including all 'seating areas', 'vestibules' and 'gangways'.
saloon-CCTV system	A system that captures images of the saloon to provide a sense of safety and security to passengers. Images will be recorded locally and not be transmitted between cars. Also referred to as CCTV or CCTV system.
seating area	An area of the 'saloon' containing seats for 'passengers', including the 'gangway' through that area.
standback	An interior panelling assembly adjacent to a 'passenger doorway'.
Stiletto heel loadcase	Loadcase based on the maximum load over minimum area applied to the 'floor surface'
supplied equipment	All equipment being delivered as part of 'PIS', 'CCTV' and/or LED lighting systems, including passenger facing equipment, operator facing equipment, underseat equipment and cabling. On 72TS, this refers to PIS (including 'wheelchair PEA') and LED lighting. On 92TS (Central), this refers to PIS (including 'wheelchair PEA', CCTV and LED lighting. On 92TS (W&C), this refers to LED lighting only.
tare	The mass of the train in operational condition, including full reserves of necessary consumables and the 'train operator' (taken to weigh 75kg, including equipment).
technical liquids	Lubricants, including greases, and electrically insulating liquids, such as transformer oils and refrigerants.
threshold strip	A single band of yellow running parallel with the full width of the 'floor surface' at each side 'passenger doorway'.
unmodified train/unit/car	Any operational train/unit/car of 72TS, 92TS (Central), 92TS (W&C) fleets prior to modification by the Saloon Design project.
vestibule	An area of the 'saloon' for passenger access, egress, standing and circulation, bounded by 'passenger doorways', 'standbacks' and 'seating areas', including the 'gangway' through that area.

wheelchair passenger emergency alarm	wheelchair PEA	<p>A device located in a wheelchair space that allows a person in a wheelchair to communicate with the 'train operator' to the same extent as if any other person operated any other PEA in the train.</p> <p>Note: On 72TS, the PEAs are part of a circuit which is broken by PEA activation, alerting the 'train operator' On 92TS, the PEAs also provide a communications link between the saloon and 'train operator'.</p>
wheelchair space		<p>A space for a disabled person in a wheelchair as defined by RVAR (and this TRS).</p>
wheelchair space backboard		<p>A physical structure that prevents wheelchair tipping when a wheelchair is parked with its back to the structure, and meets the requirements in this TRS.</p>
wheelchair-compatible doorway		<p>A 'passenger doorway' that provides wheelchair users with access to a wheelchair space in a 'modified train'.</p> <p>Note: in practice this means the 'passenger doorways' that are most adjacent to the 'wheelchair space'.</p>

4. SCOPE

4.1 Introduction

4.1.1 The high-level requirements of the Saloon Design project are described for each stock below, in order to ultimately contribute to the extension of each stock's life.

- The 72TS Saloon Design high-level requirements are to produce designs to enable fitting of LED lighting and to ensure compliance with RVAR legislation.
- The 92TS (Central) Saloon Design high-level requirements are to produce designs to repair floor corrosion, implement door pillar inspection panels, refurbish handrails, enable fitting of LED lighting and saloon CCTV and to ensure compliance with RVAR legislation.
- The 92TS (W&C) Saloon Design high-level requirements are to produce designs that enable the fitting of LED lighting and to ensure compliance with RVAR legislation.

4.1.2 The scope of the Saloon Design project is to design 'modifications' to the saloon (and minor modifications to the cab) of 72TS, 92TS (Central) and 92TS (W&C), in order to satisfy these high-level requirements.

4.1.3 There are four scope categories:

- (a) Feasibility Investigation (92TS Central only)
- (b) Design
- (c) Prototype component supply
- (d) Train one component supply (92TS Central only)

4.1.4 **Note:** The following systems are referred to in this document as the 'supplied equipment':

- Passenger Information System (PIS)
- Saloon-CCTV system
- LED lighting

4.2 Feasibility investigation - Component positioning - 92TS (Central)

4.2.1 The scope of the feasibility investigation is to determine the optimum position within the car interior for:

- Saloon LED lighting (new)
- Saloon PIS loudspeakers (new or existing, see note below)
- Saloon CCTV cameras (new)

Note: The PIS TRS requires an assessment to be conducted by the PIS supplier on the saloon loudspeakers to determine whether they should be retained or replaced.

4.2.2 The recommendations from the feasibility investigation will be used to agree positions for the components with the 'LU Engineer'.

4.3 Design

4.3.1 The scope of design for 72TS is:

- (a) wheelchair spaces within 3-car units, including relocation of equipment

- (b) the physical integration of wheelchair PEAs (supplied as part of the 'supplied equipment')
- (c) new handrails at 'passenger doorways': on both sides of double doorways and one side at single doorways
- (d) the physical integration of a 'PIS' in the saloon and cab, and removal of 'redundant equipment'

4.3.2 The scope of design for 92TS (Central) is:

- (a) wheelchair spaces within AB units
- (b) the physical integration of wheelchair PEAs (supplied as part of the 'supplied equipment')
- (c) floor corrosion repair and floor replacement processes, including:
 - (i) removal of the existing 'floor covering system'
 - (ii) assessment of corrosion levels
 - (iii) corrosion removal and damage stabilisation
 - (iv) corrosion damage repair
 - (v) installation of a replacement 'floor covering system'
- (d) a product specification for procurement of a replacement 'floor covering system'
- (e) an improved design of side door sill plate
- (f) inspection panels for door pillars
- (g) refurbishment of the existing handrails
- (h) the physical integration of a 'PIS' in the saloon and cab, and removal of 'redundant equipment'
- (i) the physical integration of a CCTV system in the saloon
- (j) the physical integration of saloon LED lighting, and removal of 'redundant equipment'

4.3.3 The scope of design for 92TS (W&C) is:

- (a) a product specification for procurement of a replacement 'floor covering system'
- (b) an improved design of side door sill plate
- (c) inspection panels for door pillars
- (d) refurbishment of the existing handrails
- (e) the physical integration of saloon LED lighting, and removal of 'redundant equipment'

4.3.4 There will be significant overlap of the identical scope items between 92TS (Central) and 92TS (W&C).

4.3.5 The physical integration of 'supplied equipment' includes:

- Determination of appropriate locations for the equipment (including all cable routing), considering the feasibility investigation, available space envelopes and operational and maintenance constraints. Appropriate locations will be subject to agreement with the 'LU Engineer' and 'supplied equipment' suppliers.
- The design of all bracketry and fasteners required to secure all equipment (including cabling) in agreed locations.

4.4 Prototype component supply

4.4.1 The supply of all components required to successfully implement 'prototype modifications' on one train set is in scope.

4.4.2 Additionally, the supply of a second train set of prototype components is in scope. These components will be used by the 'purchaser' to facilitate the prototyping of other modifications that are part of the 'Central Line Improvement Programme' (CLIP).

Note: Section 8.1, Req. ID 2200 provides the detail of this scope of supply.

4.5 Train one component supply - 92TS (Central)

4.5.1 On 92TS (Central), the supply of the first train's components manufactured to the production design is in scope.

5. DESIGN APPROACH

5.1.1 The 'supplied equipment' is being procured in parallel with Saloon Design and so the required information for physical integration (defined in interface definition documents) will be supplied during the Saloon Design project. The supplied equipment will have little effect on the designs of the floor, wheelchair spaces and handrails. Therefore the design scope can be split into two workstreams:

- **Below waistrail**, largely consisting of those modifications physically located below the waistrail which do not require any knowledge of the 'supplied equipment'
- **Above waistrail**, largely consisting of those modifications physically located above the waistrail (and some located in the seat bays or electrical compartments) that will require information about the 'supplied systems' to complete the designs

5.1.2 The matrix below shows the scope items within each workstreams for each stock.

Workstream	72TS	92TS (Central)	92TS (W&C)
Below waistrail		Floor corrosion repairs	
		Floor covering	Floor covering
		Sill plate	Sill plate
	Wheelchair spaces	Wheelchair spaces	
	Wheelchair space PEA location	Wheelchair space PEA location	
	Handrails	Handrails	Handrails
		Door pillar inspection	

		panels	
Above waistrail	PIS integration	Feasibility Investigation - Component Positioning PIS integration CCTV integration LED lighting integration	LED lighting integration

6. IDENTIFIED INTERFACES

6.1 Supplied Equipment

6.1.1 'Supplied equipment' consists of both cab and saloon equipment, some of which are 'train operator' or passenger facing.

6.1.2 The 'purchaser' will procure the 'supplied equipment' under separate contracts and will manage the interface between the 'designer' and the suppliers with the collaboration of all parties.

6.2 Passenger Information System (PIS) – 72TS & 92TS (Central)

6.2.1 The 'Invitation to Tender' (ITT) for PIS was issued shortly after the Saloon Design ITT; 23rd September 2016. It is expected that the contract will be awarded in March 2017.

6.2.2 The PIS TRS specifies a system that will replace all existing equipment associated with the audio communications system on 'unmodified trains' with the option to retain equipment such as loudspeakers and cab handsets.

6.2.3 The PIS is likely to incorporate:

- a 'train operator' facing control panel and handset
- on 72TS, a new cab loudspeaker (there is not one, explicitly for audio communications, in 72TS 'unmodified trains')
- on 92TS (Central), a replacement destination display
- on 72TS and 92TS (Central), new wheelchair space PEAs electrically integrated into the PIS and the existing PEA system
- a system controller in cars with cabs (except 72TS 'middle' DMs)
- a coach controller in all cars
- six visual displays per car
- saloon loudspeakers
- associated communication cabling and power wiring

6.2.4 The PIS TRS is intentionally flexible to the interpretation of 'visual displays', meaning either traditional scrolling text displays or advertising sized screens. The preferred approach will be confirmed at PIS Contract Award.

6.3 Saloon CCTV – 92TS (Central)

6.3.1 The ITT for CCTV will be issued shortly after the Saloon Design and PIS ITTs.

6.3.2 The CCTV TRS is specifying a new system that operates on a per-car basis (i.e. no inter-car connections) to view the saloon for security and safety benefits.

6.3.3 The CCTV system is likely to incorporate:

- a digital video recorder that controls and stores the images of all the cameras in that car. It is also the download point to collect the images from that car.
- two to four cameras to be mounted within the ceiling and/or above the doors at the end of the cars
- associated communication cabling and power wiring

6.4 LED lighting – 92TS (Central) & 92TS (W&C)

6.4.1 LED lighting will be procured to fit into the space envelopes and fixing points provided by the designer as part of the LED lighting integration workstream. LED lighting integration design will therefore take place in advance of LED lighting procurement.

6.4.2 The LED lighting system is likely to incorporate:

- LED luminaires with integrated LED lighting and diffuser panel.
- associated power wiring

6.5 Installation

6.5.1 'Modifications' to 72TS and 92TS (Central) are likely to be undertaken in a purpose built train modification work shed ('Acton TMU facility') and 'modifications' on 92TS (W&C) will be undertaken in an existing operational maintenance depot (Waterloo depot) with limited space and access.

6.5.2 It is anticipated that implementation of these modifications will take place in parallel with other work streams on up to five trains at a time at a frequency of up to one train every 10 days.

6.6 Other interfaces

6.6.1 Other interfaces to consider on 72TS are:

- (a) The Weld Repairs project are conducting repairs throughout the carbody structure. The scope of their project includes replacement of the 'floor covering system' and the seat moquette. There is also significant redesign of some structural components.
- (b) In addition to the modifications being conducted by the Weld Repairs project, a component named the door pillar foot is undergoing further modification to facilitate Saloon Design. The design of the door pillar foot that is currently being installed is difficult to disassemble (it was anticipated to remain in place

for the life of the fleet). However, feasibility studies indicated that the door pillar foot may require modification to act as the connection point for the 'doorway handrails'. Therefore, a further redesign will be implemented and will be available for the 'designer' to use for 'doorway handrails' if deemed appropriate.

- (c) The existing saloon fluorescent lighting is being replaced with LED lighting by the 72TS Saloon LED lighting project. The LED lighting will utilise the space envelopes of the existing fluorescent lighting and installation is due to be complete before Saloon Design modifications commence.

6.6.2 Other interfaces to consider on 92TS (Central) are the following projects which form the 'Central Line Improvement Programme' (CLIP):

- (a) **AC traction.** The re-tractioning of all trains from the use of DC motors to AC motors. The majority of the works are expected to be below sole bar but there will be elements requiring access to existing equipment under saloon seats. This project is currently evaluating bids to award the design contract.
- (b) **DTS.** The replacement of the Data Transmission System (DTS) to improve reliability. This is expected to interface with 'PIS' and 'CCTV'. This project is currently evaluating bids to award the design and supply contract.
- (c) **Hainault-Woodford Shuttle.** This is the proposal of providing a 92TS 4-car shuttle service between these stations on the line, allowing more 8-car trains to be available for service on the remainder of the line. This will mean some 92TS will run as 4-car trains.

6.6.3 There are no other interfaces identified to consider on 92TS (W&C).

7. ASSUMPTIONS, DEPENDENCIES AND CAVEATS

A, D or C	ADC Description	ADC ID
D	On 72TS, LED lighting is required in order for the PIS to function due to power availability. LED lighting is expected to reduce power consumption sufficiently to give power provision for PIS.	1
A	On 72TS, the saloon design 'modifications' will take place on trains that have undergone or are undergoing works associated with the Weld Repairs project.	2
D	On 72TS, the door pillar foot modification will be implemented at the same time or before the Saloon Design project.	3
A	72TS 'modifications' will be implemented at the 'Acton TMU facility'.	4
A	92TS (Central) 'modifications' will be implemented at the 'Acton TMU facility'.	5
A	92TS (W&C) 'modifications' will be implemented at Waterloo depot.	6

8. GENERAL REQUIREMENTS

8.1 Scope and outputs

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

<p>For the 92TS (Central) component positioning feasibility investigation, the 'designer' shall produce a concluding document, detailing:</p> <ul style="list-style-type: none"> • High-level general arrangements for the options • The benefits of each option, including the lighting, acoustic and CCTV image benefits • The amount and cost of 'modifications' for each option • The installation cost of each option • A benefit to cost analysis and recommendation <p>Note: requirements for each feasibility option are defined in Section 9.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 2150</p>
<p>The 'designer' shall design 'modifications' suitable to be fitted to the 36 x 7-car trains of 72TS, made up of 36 x 4-car units and 36 x 3-car units (252 cars), which run on the Bakerloo line.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1148</p>
<p>The 'designer' shall design 'modifications' suitable to be fitted to the 85 x 8-car trains of 92TS, made up of 175 x 2-car AB units and 165 x 2-car BC units (680 cars), which run on the Central line.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 202</p>
<p>The 'designer' shall design 'modifications' suitable to be fitted to the 5 x 4-car trains of 92TS, made up of 10 x 2-car EF units, which run on the Waterloo and City line.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1149</p>
<p>On 72TS, 'modifications' shall include the scope items listed in paragraph 4.3.1.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1151</p>
<p>On 92TS (Central line), 'modifications' shall include the scope items listed in paragraph 4.3.2.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 203</p>
<p>On 92TS (W&C), 'modifications' shall include the scope items listed in paragraph 4.3.3.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1150</p>
<p>During the design stage, the documentation specified in Section 13 shall be provided when required by the Design Acceptance Process (Section 12).</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 2151</p>
<p>The outputs of the Saloon Design project shall ensure the 'purchaser' can implement (procure, install and maintain) the 'modifications' in line with the design requirements.</p>	<p><input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 2152</p>

For bespoke components, brackets, panels, enclosures and modifications to existing components, a full PS (as specified in Section 13) is required 2153

Note: this includes:

- part, assembly and installation drawings which can be used for manufacture and installation
- a full Bill of Materials including specifications for off the shelf fixings, fasteners, adhesives etc.
- a full Tooling List, including designs for any specialist tooling required
- installation instructions and drawings
- maintenance instructions

For parts that require specialist manufacturing (i.e. the ‘floor covering system’), the following outputs are required, as a minimum: 2154

- product specification suitable for an Invitation to Tender, that specifies a product that will be compatible with the interfacing ‘modifications’
- installation instructions and drawings
- maintenance instructions

Where the solution requires a process, the following outputs are required, as a minimum: 2155

- process instructions (including specifications for specialist tooling)
- training materials (if required)
- maintenance instructions

The ‘designer’ shall supply all parts and components necessary to successfully complete the ‘prototype modifications’ on a minimum of: 2156

- On 72TS: at least one 3-car unit (3 cars) for ‘below waistrail’ modifications and one 7-car train for ‘above waistrail’ modifications.
- On 92TS (Central): one 2-car AB unit (2 cars) for the ‘below waistrail’ modifications and 8-car train for the ‘above waistrail’ modifications.
- On 92TS (W&C): one 2-car unit (2 cars) for the ‘below waistrail’ and ‘above waistrail’ modifications.

On 92TS (Central), in addition to the parts and components supplied for the purposes of prototyping, the designer shall supply all parts and components necessary to implement the ‘above waistrail’ ‘prototype modifications’ on another four 2-car units (8 cars). 2200

On 92TS (Central), the designer’ shall supply all parts and components necessary to implement both the ‘below waistrail’ and ‘above waistrail’ ‘production modifications’ on four 2-car units (8 cars). 2157

8.2 Design approach

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

The design acceptance process described in Section 12 shall be followed. 2158

Unless otherwise agreed, the issue of any standard which applies at the date of contract award shall be the version of that standard which is applied.	☑☑☑ 193
Note: Controlled copies of applicable and agreed LU standards are available via the LU standards portal https://www.ihs.com/permission/lul-standards/index.html	
For the avoidance of doubt, where standards or specific requirements do not contradict, but parts of one are more onerous than the other, the more onerous requirements from each shall be used.	☑☑☑ 194
The 'designer' shall be responsible for checking the validity of documentation or information referenced by this TRS.	☑☑☑ 196
Any supporting documentation or information referred to in this TRS is provided for the 'designer's information and guidance only. The 'purchaser' shall not accept any liability including delays or costs resulting from any information this may contain.	☑☑☑ 195
Note: A limited suite of drawings exists for London Underground rolling stock. The drawings are uncontrolled copies, supplied by the London Underground drawing office or the original equipment manufacturers. It is understood that the rolling stock was built according to these drawings, however, the 'purchaser' cannot offer any guarantees as to the degree of drawing compliance or accuracy which has been achieved. Experience indicates that whilst most information on the drawings appear to be accurate, certain aspects of the rolling stock may differ slightly from that presented in the drawings.	
The 'designer' shall survey the rolling stock to determine, as far as possible, all information required to deliver the Saloon Design project.	☑☑☑ 198
The 'designer' shall be responsible for making all necessary enquiries and for obtaining all information required to enable it to meet the requirements of this TRS.	☑☑☑ 197
The 'designer' shall support the 'purchaser' in fulfilling the requirements of S1538.	☑☑☑ 199
The 'designer' shall provide assurance that the requirements defined in this TRS have been complied with, and that controlled processes have been followed in achieving the deliverables.	☑☑☑ 201
Design shall be split into two workstreams: <ul style="list-style-type: none"> • Below waistrail • Above waistrail as defined in Section 5.	☑☑☑ 2159

8.3 Interfaces

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

The 'designer' shall manage the interface between below waistrail and above waistrail workstreams. 2160

The 'designer' shall manage the interfaces between 'modification' scope items. 2161

The 'designer' shall manage the interfaces between 'modifications' and the 'unmodified train'. 2162

Note: this includes interfaces with other works, identified in Section 6.

The 'designer' shall continuously collaborate with the 'purchaser' and the suppliers of the 'supplied equipment'. 2163

Note: this is to facilitate the 'purchaser' being able to control and define the interfaces between the 'modifications' and the 'supplied equipment', and assist with, where relevant, compliance with this TRS.

Physical integration of the 'supplied equipment' shall comply with the agreed Interface Definition Documents for all interfaces. 2165

Note: The 'purchaser' and suppliers of the 'supplied equipment' will produce equipment space envelopes, and installation requirements and constraints to form the Interface Definition Documents.

Interface Definition Documents relating to the other interfaces, identified in 6.6, shall also be agreed with the suppliers of the associated equipment.

9. FEASIBILITY INVESTIGATION REQUIREMENTS (92TS CENTRAL ONLY)

9.1 Feasibility scope

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

The 'designer' shall undertake a feasibility investigation to determine the costs and benefits associated with Feasibility Option 1 and Option 2. 2166

Feasibility option 1 shall consider the installation of LED light panel luminaires within the space envelopes of the existing fluorescent lighting, retaining the existing position of saloon lighting. (It is envisaged that new bracketry would be required to accommodate this). Loudspeakers (existing or replacement) shall remain in their existing positions and CCTV cameras shall be incorporated into the saloon in a position to most effectively satisfy the requirements (section 9.3). 2167

Feasibility option 2 shall consider the relocation of the saloon lighting from the current positions above the advert panels and in a line down the centre of the car ceiling to form two new lines, one down each side of the ceiling, between the existing central lighting and the ceiling mounted horizontal handrails. 2168

This is in line with the saloon lighting approach taken on other tube stocks (for example, 09TS). The existing central ceiling lighting and 'advert panel lighting' shall be removed and the loudspeakers and CCTV cameras positioned in the space created along the centre of the car ceiling.

Note: The high level aim is to improve ambience through more effective lighting and use the opportunity to improve CCTV camera and PIS loudspeaker positioning.

For each option, the 'designer' shall consider the feasibility and benefits of implementation including: 2169

- (a) Compliance with the requirements in Section 9.2 to 9.4
- (b) Saloon environment ambience, including impact on lighting, acoustic performance and CCTV viewing angles
- (c) Any negative effect on compliance with requirements in this TRS
- (d) Equipment cost (effect on reusability of existing equipment)
- (e) Integration design cost
- (f) Installation cost
- (g) Maintenance, including any cost implications

9.2 LED lighting

9.2.1 **Note:** in this section, applicability columns refer to Options 1 and 2.

Requirement Text

OPTION 1
OPTION 2
Req ID

For Option 1, LED modules shall be positioned within the space envelopes of the existing line of fluorescent luminaires running longitudinally along the centre of the car ceiling, and within the aperture currently occupied by the existing fluorescent luminaires above the saloon advertisement cards. 2125

For Option 2, LED modules shall be positioned in two lines running longitudinally along each side of the car ceiling in a manner that replicates the saloon lighting arrangement on other London Underground Tube Stocks (e.g. 09TS) as far as practicable. 2126

For Option 2, the space envelopes of the fluorescent luminaires in 'unmodified trains' along the centre of the car ceiling and the aperture above the saloon advertisement cards (the 'advert panel lighting') shall be made available for other uses or remodelled to maximise interior space for passenger use. 2127

All passenger information and advertisement cards shall be clearly readable under LED lighting. 2128

The LED lighting shall: 2129
 (a) enable uniform illumination, minimising glare and shadowing, to give a warm and welcoming ambience
 (b) allow the entire interior to be clearly visible in all environments, under both normal and emergency lighting conditions

The LED lighting shall provide normal lighting with illuminance of between 350 lux and 400 lux at: 2130
 (a) seating positions
 (b) the longitudinal centreline of the car, 1500mm above the 'floor surface'

The 'uniformity of illuminance' of the LED lighting, under normal lighting shall be at least 0.5, calculated separately for seating positions and along the longitudinal centreline of the car. 2131

The LED lighting shall provide emergency lighting with an illuminance of at least: 2332
 (a) 30 lux at:
 (i) the centre of cab partition (J) and train end (M) doorways, at the 'floor surface'
 (ii) seating positions
 (iii) the longitudinal centre line of the car, at the 'floor surface';
 (b) 33 lux at the centre of saloon side doorways, at the 'floor surface'
 (c) 50 lux at exit signs and PEAs (including wheelchair space PEAs)

The LED lighting shall provide a 'uniformity of illuminance' for emergency lighting of at least 0.25, calculated from all specified measurements. 2133

9.3 CCTV cameras

9.3.1 **Note:** in this section, applicability columns refer to Options 1 and 2.

Requirement Text

OPTION 1
OPTION 2
Req ID

For Option 1, CCTV cameras shall be positioned in space currently available within the 'unmodified train' saloon. 2134

For Option 2, CCTV cameras shall be positioned along the longitudinal centre line of the car ceiling making use of space currently occupied by fluorescent lighting. 2135

Modified trains shall have at least two CCTV cameras per car. 2136

CCTV cameras may include hidden cameras above R and S doors, as well as fish-eye style, ceiling mounted cameras. 2137

The CCTV System shall be able to observe 90% of the volume of space within the car. 2138

Note: "Observe" is as defined in BS EN 62676-4.

It shall be possible to identify person(s) in the 'vestibule' areas. 2139

Note: "Identify" is as defined in BS EN 62676-4.

It shall be possible to recognise person(s) in the area of the internal cab doors, defined as "J" doors. 2140

Note: "Recognise" is as defined in BS EN 62676-4.

9.4 PIS loudspeakers

9.4.1 **Note:** in this section, applicability columns refer to Options 1 and 2.

Requirement Text

OPTION 1
OPTION 2
Req ID

For Option 1, PIS loudspeakers shall be positioned in their existing space envelopes as found on the 'unmodified train'. 2141

For Option 2, PIS loudspeakers shall be positioned in the centre of the car ceiling in space made available by the removal of the fluorescent lighting on 'unmodified trains'. Positioning shall replicate the saloon loudspeaker arrangement on other London Underground Tube Stocks (e.g. 09TS) as far as practicable. 2142

PIS loudspeakers shall enable an average sound pressure level capability of at least 90dB(A) which shall not exceed 95dB(A), with a short duration peak limit of 100dB(A), measured at any point in the car at a height of 1600mm above saloon floor level, shall be assessed. 2143

10. FUNCTIONAL REQUIREMENTS

10.1 Floor repairs - 92TS (Central) & 92TS (W&C)

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

- The floor repair design shall comprise of the following: ☒☒☒ 2170
- (a) A fully detailed process for all activities required to remove the existing floor covering, adhesive and body filler and implement a repair of all floor corrosion damage
- (b) A fully detailed installation design for a replacement 'floor covering system' including arrangement, installation process and material specifications
- The 'designer' shall investigate and establish best industry practice processes and materials for the activities associated with the floor corrosion repair and 'floor covering system' replacement. ☒☒☒ 2171
- A process to remove the existing 'floor covering system' and body filler present in the floor areas of 'unmodified cars' shall be developed. ☒☒☒ 2172
- A process to measure the level of corrosion damage and detect any defects in the aluminium floor following removal of the floor covering shall be developed. ☒☒☒ 1519
- The corrosion measurement process shall produce results that can be readily interpreted in order to determine the appropriate corrosion repair methodology. The required accuracy of this measurement process is therefore dependent upon the applicability of the designed repair methods. ☒☒☒ 1520
- A process to assess the severity of corrosion in areas of the floor that are difficult to access, such as under the seats and equipment cabinets, shall be developed. ☒☒☒ 1521
- A process to remove (as far as reasonably practicable) all corrosion from the floor area and to treat affected areas with a form of corrosion inhibitor to prevent any further corrosion initiation or propagation shall be developed. All areas of floor including the saloon and cab areas, under door sill plates, under the seat bays and under the centre grab pole bases shall be included. ☒☒☒ 1831
- The floor covering and corrosion removal processes shall not result in excessive removal of or damage to sound, uncorroded aluminium. ☒☒☒ 1524
- A process to repair the damage caused by corrosion shall be developed. ☒☒☒ 2173
- Note:** Following previous investigations (see section 17), the corrosion damage has been categorised into 3 levels:
- Minor corrosion
 - Moderate corrosion
 - Major corrosion

- Minor corrosion damage shall be defined as corrosion damage that reduces the thickness of the top skin of aluminium floor structure by anywhere up to a level where it becomes at risk of damage when subjected to the 'stiletto heel' loadcase. ☒☑☑ 2174
- Moderate corrosion damage shall be defined as corrosion damage that reduces the thickness of the top skin of aluminium floor structure to a level where damage or failure would occur when subjected to the 'stiletto heel' loadcase, or where there are through holes. ☒☑☑ 2175
- Major corrosion damage shall be defined as corrosion damage that requires a weld repair to restore the structural integrity of the floor. ☒☑☑ 2176
- A 'stiletto heel loadcase' shall be developed based on the maximum load over minimum area that could reasonably be applied to the 'floor surface' and transmitted into the floor structure. ☒☑☑ 2115
- Minor corrosion shall be repaired using a suitable filler material that will fill the corrosion damage and provide a smooth surface for the application of the 'floor covering system'. ☒☑☑ 1527
- Filler material shall be compatible with the 'floor covering system' and the differential expansion, bending stiffness and strength requirements for the areas in which it is used. ☒☑☑ 1528
- Moderate corrosion shall be repaired using a method developed by the 'designer' to mitigate the risk of floor puncturing under the 'stiletto heel loadcase' and local floor buckling under carbody proof loadcases in areas of moderate corrosion damage. ☒☑☑ 1531
- Welding or over-plating shall not form the basis of the moderate corrosion repair method. An alternative method that mitigates the issues associated with welding and over-plating highlighted in section 17.2 is required. ☒☑☑ 2187
- The moderate corrosion repair method shall accommodate the differential expansion, bending stiffness and strength requirements for the areas in which it is implemented. ☒☑☑ 1532
- The moderate corrosion repair method shall be able to be implemented efficiently throughout the floor area as required. ☒☑☑ 1533
- Major corrosion shall be repaired using a weld repair process. The existing weld repair methodology shall be productionised to maximise process efficiency and sequenced to minimise the requirements for equipment disconnection and other preparatory works. ☒☑☑ 1529
- The structural analysis completed previously to consider the effects of corrosion on 92TS floors can be used to aid the design and structural justification of the repair methods as applicable (see PVEC3126-TR-02-001). ☒☑☑ 2177

Corrosion repairs shall provide a sound, flat floor surface onto which the replacement 'floor covering system' can be bonded. ☒☑☑ 1534

A process shall be developed to pre-treat the aluminium floor structure before the installation of the replacement 'floor covering system'. This process shall:
(a) prevent hydration of the aluminium oxide on the aluminium surface
(b) ensure that the aluminium surface is prepared to achieve the optimum bonding performance of the corrosion damage repairs and replacement 'floor covering system' ☒☑☑ 1536

10.2 Replacement floor covering system

10.2.1 Floor covering system

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

On 72TS 'floor covering system' layout utilising existing material specifications shall be designed for the special trailer cars modified to include a 'wheelchair space'. ☒☒☒ 2009

On 92TS (Central) and 92TS (W&C), a replacement 'floor covering system' layout design and installation process shall be developed for each variant of 92TS car floor (including B-cars with and without wheelchair spaces). ☒☑☑ 2112

The non-metallic floor covering requirements specified in Appendix B/ Section 16.3 shall be developed into a product specification appropriate for the competitive procurement of the materials that make up the replacement 'floor covering system'. These materials shall provide a 'floor covering system' in accordance with the requirements of this TRS. ☒☑☑ 2114

The base colour and fleck colour, size and density shall be as specified in the Aesthetic Concept. ☒☑☑ 1556

The 72TS Weld Repairs project is currently replacing the 'floor covering system' as part of their scope of work. The new floor area created by the 'wheelchair space' shall utilise the 'floor covering system' materials and installation processes currently utilised on the Weld Repairs project. ☑☒☒ 1613

The replacement 'floor covering system' shall fully seal the 'floor surface' and prevent liquid ingress of any kind on to the aluminium floor structure. Particular attention to the known weak points of the existing 'floor covering system', which are the joints, the interface with the sill plates and the interfaces between 'floor covering' and coving and between 'floor covering' and grab pole base is required. ☑☑☑ 1557

Note: Liquids to which the 'floor covering system' may be exposed include, but are not limited to; cleaning products in the LU Approved Products Register, snow, rain, ice, drinks, paint (graffiti), urine, vomit and technical liquids used in maintenance.

Joints in and between 'floor surfaces' shall be minimised and located so as to minimise their: ☑☑☑ 856

- (a) Exposure to passenger traffic
- (b) Coincidence with joints in supporting structures

Note: Joints in and between 'floor surfaces' include joints between sheets of 'floor covering', joints to sill plates and joints with vertical surfaces and covings.

Interior 'floor surfaces' shall not have drainage holes. ☑☑☑ 853

The limit of acceptable flatness of the surface of the 'floor covering' is -1.0mm measured below a 300mm straight edge in any location and orientation including across sheet joints. ☑☑☑ 1564

The design of the replacement 'floor surfaces' shall: ☑☑☑ 94

- (a) Prevent the accumulation of liquid on 'floor surfaces'
- (b) Prevent liquid ingress at the joints between 'floor surfaces'

The design of the 'floor covering' to coving detail shall facilitate ease of cleaning and shall avoid dirt traps and regions of liquid retention. ☑☑☑ 1565

The replacement 'floor covering system' at 'wheelchair-compatible doorways' shall provide a safe and secure interface for a fully-loaded manual boarding ramp. ☑☑☑ 95

'Floor surfaces' shall not pose a trip hazard. ☑☑☑ 91

Note: 'Floor coverings' have specific tolerances contained in MACS

'Floor surfaces' shall have a pendulum test value of at least 36 in the worst-case orientation, in both wet and dry conditions, measured in accordance with BS 7976-2. Tests shall be carried out for both profiled and un-profiled sections of 'floor surface' and after the application of any installation and/or maintenance surface treatment, such as sealant or polish. ☑☑☑ 92

10.2.2 Threshold strips - 92TS (Central) and 92TS (W&C)

Requirement Text	72TS 92TS (Central) 92TS (W&C) Req ID
The 'floor surface' at each side 'passenger doorway' in each 'modified car' shall have a single band of yellow running parallel with the full width of the doorway, which shall be known as a 'threshold strip'.	☒☒☒ 87
A 'threshold strip' shall be between 50mm and 100mm wide perpendicular to the doorway opening at each 'passenger doorway'.	☒☒☒ 88
The edge of a 'threshold strip' furthest from its corresponding 'passenger doorway' shall be no more than 100mm from the edge of the 'floor surface' at that 'passenger doorway'.	☒☒☒ 89
'Threshold strips' shall be the colour specified by the 'Aesthetic Concept'.	☒☒☒ 90
'Threshold strips' shall be considered 'floor surfaces' and shall therefore comply with the requirements in Section 10.2.1 of this TRS.	☒☒☒ 1135
'Threshold strips' shall be able to be replaced without removal of door leaves.	☒☒☒ 2108
'Threshold strips' which do not comply with this TRS in 'unmodified trains' shall not form part of the 'modified train' design.	☒☒☒ 852

10.3 Grab pole base - 92TS (Central) & 92TS (W&C)

Requirement Text	72TS 92TS (Central) 92TS (W&C) Req ID
The revised design of grab pole base (LU drawing 200346) shall be reviewed by the 'designer' and further modified if necessary to account for corrosion damage in the area of floor around the grab pole base and to enable compliance of the joint between the base and replacement 'floor covering' with the requirements in Section 10.2 of this TRS.	☒☒☒ 1551

10.4 Seat base brackets - 92TS (Central) & 92TS (W&C)

Requirement Text	72TS 92TS (Central) 92TS (W&C) Req ID
Due to corrosion, the fixings between seat base bracketry and saloon floor are known to be compromised. The 'designer' shall prepare a fully detailed repair process to address the corrosion and loss of joint integrity of these seat base fixings.	☒☒☒ 1554

10.5 Sill plate - 92TS (Central) & 92TS (W&C)

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

A new design and installation process for the sill plates shall be developed which: ☒☑☑ 2178

(a) Improves the interface between sill plate and floor covering in line with the 'replacement floor covering' requirements of this TRS

(b) Incorporates a 'threshold strip' on passenger side doors only (i.e. not cab side doors)

(c) Eliminates the need to remove the door leaves before the main body of the sill plate can be removed to allow for full replacement of the floor covering

Note: the installation of the redesigned sill plates is likely to occur prior to the implementation of the full floor repair and replacement floor covering.

Consideration shall be given to extending the sill plate further into the car to act as a method of repair for any moderate corrosion damage (see Section 10.1) in the area directly in front of the existing sill plate. ☒☑☑ 2179

The parts of the existing sill plate design that interface with the door system, including the door leaf, shall be replicated in the new sill plate design and shall not be modified in any way. ☒☑☑ 2037

'Modifications' to the sill plate arrangement shall maintain the degree of lower edge guidance and support provided to the door leaves by the 'unmodified car'. ☒☑☑ 161

'Modifications' to the sill plate arrangement shall maintain the same tolerance limits for the door guide positioning as the 'unmodified train'. ☒☑☑ 2180

The modified sill plate arrangement shall sustain a pressure of 7 kN/m² applied to the door leaf acting transversely out of the car over the area of the door leaf exposed to the saloon when the door leaf is closed, as may occur in an overturning scenario, for at least 5 minutes. ☒☑☑ 164

The modified sill plate shall not affect the operation of the door systems, e.g. door interlock setting and performance. ☒☑☑ 172

The modified sill plate arrangement shall be designed to prevent litter becoming lodged and inhibit movement of the door leaf. ☒☑☑ 171

Note: refer to the Environmental Context Document

The modified sill plate shall not inhibit the shedding of water from inside the car due to heavy rain and wet floor cleaning. ☒☑☑ 175

The modified sill plate shall be either partially or fully removable, without removing the door leaves, to allow redress of the 'floor covering' to sill plate interface. ☒☒☒ 1503

The modified sill plate shall incorporate a 'threshold strip'. ☒☒☒ 2038

The 'exposed surfaces' of the modified sill plate shall be considered a 'floor surface'. ☒☒☒ 2116

10.6 Door pillar inspection panels - 92TS (Central) & 92TS (W&C)

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

The door pillar inspection panels shall form part of the interior door pillar panelling. ☒☒☒ 2117

On removal, the door pillar inspection panels shall fully expose the lower door pillar corner radii to allow NDT inspection of the door pillars at the known crack locations (Refer to Section 15.10). ☒☒☒ 2118

The door pillar inspection panels shall be removable and replaceable in approximately 10 minutes (for each activity) without the need for specialist tools. ☒☒☒ 2119

10.7 Wheelchair spaces – 72TS & 92TS (Central)

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

There shall be two wheelchair spaces in each 72TS 'Special Trailer', located on the No. 2 side in place of the centre seat bay (between saloon doors C & E). ☒☒☒ 69

There shall be two wheelchair spaces on each 92TS 'AB unit', located on the number No. 2 side in place of the centre seat bay of the B car (between saloon doors C & E). ☒☒☒ 848

A 'wheelchair space' shall be at least 1300mm 'longitudinally', 750mm 'laterally' and 1600mm vertically from the 'floor surface'. ☒☒☒ 71

A 'wheelchair space' shall not have a slope with a gradient exceeding 5% 'laterally', or any slope 'longitudinally'. ☒☒☒ 74

'Floor surfaces' of 'wheelchair spaces' shall be able to support a 'reference wheelchair' with an occupied mass of 325kg. ☒☒☒ 80

- A 'wheelchair space' shall be immediately adjacent to a 'wheelchair space backboard' measuring at least 700mm laterally, capable of preventing a 'reference wheelchair', with its back against it, from tipping in the direction of the 'wheelchair space backboard'. ☑☑☑ 1124
- The 'wheelchair space backboard' shall provide a flat surface facing the 'wheelchair space' to allow a sign of 150mm in width and 250mm in height to be adhered to it. ☑☑☑ 1186
- 'Wheelchair space backboards' shall not prevent seated and standing passengers from the 'reference population' to see from one end of the car to the other. ☑☑☑ 1188
- The width of the 'gangway' between the 'wheelchair backboard' and the opposite seats shall be maximised. ☑☑☑ 83
- There shall be no obstruction to prevent a 'reference wheelchair' being manoeuvred between a 'wheelchair space' and its nearest 'wheelchair compatible doorways' on both sides of the car. ☑☑☑ 70
- The route between a 'wheelchair-compatible doorway' and a 'wheelchair space' shall:
- (a) Not have a step
 - (b) Not have a slope exceeding 8%
 - (c) Be at least 850 millimetres wide along the whole route
 - (d) Provide a turning space adjacent to, or partly adjacent to and partly within, a 'wheelchair space' for a 'reference wheelchair' to turn the wheelchair around through 180 degrees
- ☑☑☑ 75
- The provision of handrails around seat bays which are modified for 'wheelchair spaces' shall be retained around the 'wheelchair space' as far as practicable. ☑☑☑ 1828
- In the areas around 'wheelchair spaces', any passenger within the 'reference population' between the 'vestibules' when 'fully laden' shall be able to reach at least one handrail, as far as practicable. ☑☑☑ 113
- Fittings shall not be installed within a 'wheelchair space', apart from handrails. ☑☑☑ 72
- If a 'wheelchair space' is to have a horizontal handrail, the handrail must:
- (a) Be fitted onto, and parallel with, the side of the rail vehicle
 - (b) Be at a height of between 650mm and 1000mm
 - (c) Not protrude into the 'wheelchair space' by more than 90mm
- ☑☑☑ 850

<p>If a horizontal handrail is to be fitted to the ceiling of a rail vehicle, it shall be located in a position consistent with horizontal handrails on 'unmodified trains' and shall only protrude into a 'wheelchair space', provided that:</p> <p>(a) it does so by no more than 400mm measured from the passenger 'gangway' side of that 'wheelchair space'</p> <p>(b) its height is at least 1500mm measured vertically from the floor</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1002
<p>Perch seating shall be provided 'longitudinally' adjacent to each 'wheelchair space' and shall not protrude into it.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 76
<p>Perch seating shall have the same moquette as existing seating.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 882
<p>Perch seating shall be at least 495mm 'longitudinally'.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1190
<p>Perch seating and its supporting structure shall withstand the following individually applied loads without permanent deformation or damage:</p> <p>(a) 1200N per seat vertically downwards, simultaneously applied at the centre of the front of each seat</p> <p>(b) 1000N in each longitudinal direction, applied at the uppermost part of the perch seating</p> <p>(c) 2000N per seat vertically downwards, simultaneously applied over areas of 380mm wide by 200mm deep, located centrally on each seat and applied for 5 minutes. For perch seating that is less than 200mm deep, an equivalent pressure shall be applied.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1189
<p>Where individual perch seats are not separated from each other, the loads shall be applied as if the seating were divided into 495mm 'longitudinally' individual perch seats.</p>	
<p>Underseat equipment shall be relocated to an alternative position where its function is not affected so that 'wheelchair spaces' can be installed in the specified location.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1126
<p>Note: as required by Req 4, all equipment to be relocated and all wiring and piping to be re-routed shall be agreed with the 'LU Engineer'.</p>	
<p>The effect of passenger loading in 'wheelchair spaces' on the structural integrity of the car shall be assessed, and, if required, appropriate 'modifications' shall be provided.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 2109

10.8 Wheelchair space PEAs – 72TS & 92TS (Central)

Requirement Text

72TS
 92TS (Central)
 92TS (W&C)
 Req ID

<p>On 72TS and 92TS (Central), each 'wheelchair space' shall have a position provided immediately adjacent to it for a 'wheelchair PEA'.</p>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> 1111
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Note: A 'wheelchair PEA' will be part of the 'supplied equipment'.

On 72TS and 92TS (Central), the mechanical integration of 'wheelchair PEAs' shall support the system operation of the 'supplied equipment'. 1012

The 'wheelchair PEA' shall be located within reach of a person in a 'reference wheelchair' with its back against the 'wheelchair space backboard'. 85

Note: Annex F of BS 8300 is a useful reference for fulfilling this requirement.

The physical integration of the 'wheelchair PEAs' shall not prevent actuation by the palm of the hand exerting a force of less than or equal to 30N. 1836

The 'wheelchair PEAs' actuator shall be at a height of between 900mm and 1100mm above the 'floor surface'. 1004

On 92TS (Central), communication grilles and microphones for 'wheelchair PEAs' shall be: 1008

- (a) Fitted within 300mm of each 'wheelchair PEA', and
- (b) Mounted flush to the interior panel surface

Note: these components may be integrated into the 'wheelchair PEAs'.

A 'wheelchair PEA' blanking cover shall be provided that can both: 2120

- (a) cover the 'wheelchair PEA' if it is in a non-operational state
- (b) cover the panel if a 'wheelchair PEA' is not yet fitted

10.9 Handrails

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

On 72TS, new or modified 'handrails' shall be coloured according to the Aesthetic Concept. 1121

Note: this currently states colour RAL 3009 oxide red.

On 92TS (Central), all 'handrails' (including the existing 'handrails') shall be coloured according to the Aesthetic Concept. 1122

Note: this currently states colour 'Corporate Red'.

On 92TS (W&C), all 'handrails' shall be coloured according to the Aesthetic Concept. 1827

Note: this currently states colour S 1050-B80G except for door pillar handrails for which S 0520-B70G is stated, from the Natural Colour System.

New 'handrails' and 'modified handrails' shall have a circular cross section with a diameter of between 30mm and 40mm. 104

- New 'handrails' and 'modified handrails' shall have at least 45mm clearance between any part of the handrail and any other part of the car. 105
- New 'handrails' and modified panel, partition or draughtscreen mounted 'handrails' shall have no more than 50mm clearance for a passenger's hand between any part of the handrail and any other part of the car, unless it can be demonstrated that the risk of personal injury in the event of an accident has been controlled. 1123
- On 72TS, 'doorway handrails' shall be fitted inside the saloon on either side of every double 'passenger doorway' and on the draughtscreen side of single 'passenger doorways'. 108
- On 72TS, 'doorway handrails' shall be as close as practicable to their corresponding doorways without reducing the door throughway area. 109
- On 72TS, 'doorway handrails' shall be vertical between 700mm and 1200mm above the 'floor surface'. 110
- New or modified 'handrail assemblies' shall not affect the structural integrity of 'modified trains'. 114
- New or modified 'handrail assemblies' shall be designed to facilitate easy replacement of the 'handrail'. 115
- New or modified 'handrail assemblies' mounted from the ceiling shall withstand a concentrated vertical proof load of 1700N, applied anywhere along the handrail, without exceeding the material yield stress of any part of the 'handrail assembly'. 119
- New or modified 'handrail assemblies' shall withstand a concentrated perpendicular proof load of 1700N applied anywhere along the handrail without exceeding the material yield stress of any part of the 'handrail assembly'. 120
- New or modified 'handrail assemblies', apart from horizontal handrails longer than 1m, shall withstand a proof load of 1700N, applied in the most disadvantageous manner, without exceeding the material yield stress of any part of the 'handrail assembly'. 121
- New or modified horizontal 'handrail assemblies' longer than 1m shall withstand the following proof loads, applied in the most disadvantageous manner, without exceeding the material yield stress of any part of the 'handrail assembly'. 122
- (a) 1700N per metre of handrail, applied vertically
- (b) 750N per metre of handrail, applied horizontally

New or modified 'handrail assemblies' shall withstand a concentrated load of 3400N, applied in the most disadvantageous manner, without any part of the handrail assembly reaching ultimate failure. ☑☑☑ 123

On 92TS (Central) and 92TS (W&C), the 'designer' shall prepare a process for refurbishing handrails of all types, including as a minimum:
(a) removal of the 'handrail',
(b) re-coating
(c) refitting. ☑☑☑ 2181

The 'designer' shall determine the interchangeability of the handrails (i.e. if handrails can be removed from one position and refitted in a different car and/or position) and incorporate appropriate mitigations to potential fitting issues into the process. ☑☑☑ 2182

10.10 Supplied equipment integration

10.10.1 **Note:** the requirements in this section are expected to require collaboration with the 'supplied equipment' suppliers.

10.10.2 General

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

All components associated with the 'supplied equipment', including all cabling, shall be incorporated into 'modified trains' saloon and cab such that the 'supplied equipment' functions as defined, by considering at least:
(a) space envelope of the 'supplied equipment'
(b) installation requirements, as defined in this TRS
(c) supplier requirements, as defined in the Interface Definition Documents
(d) available space in the cars
(e) cable routing
(f) ventilation
(g) sealing
(h) operating temperature
(i) orientation
(j) maintainability
(k) 'train operator'/passenger requirements
(l) electromagnetic compatibility ☑☑☑ 1117

The selected location and space envelope for the 'supplied equipment' shall be agreed with the 'LU Engineer' before design can progress. ☑☑☑ 1153

'Redundant equipment' shall be removed including fixings and bracketry. Any physical interfaces with the redundant equipment shall be modified to ensure 'modified trains' can function in the same way as 'unmodified trains'. This includes ensuring airflow, seals, water ingress protection are not negatively affected. ☑☑☑ 1619

Equipment that shall be considered 'redundant equipment' are those replaced by the 'supplied equipment' and shall be agreed with the 'LU Engineer' before design can progress. 1620

Physical integration 'modifications' shall include all components that are required to install the 'supplied equipment' in compliance with this TRS, including: 2042

- (a) bracketry
- (b) fasteners
- (c) interior panelling

10.10.3 PIS integration - 72TS & 92TS (Central)

Requirement Text

72TS
92TS (Central)
92TS (V&C)
Req ID

Six PIS visual displays shall be incorporated into the saloon, such that the display is visible from at least 51% of passenger seats and at least 51% of priority seats. 1112

Note: The PIS displays could either take the form of scrolling texting displays similar to other LU rolling stock, or of multipurpose displays to be positioned within existing advertising panels. This will be confirmed by the 'purchaser'.

PIS visual displays shall be readable by both standing and seated passengers within the 'reference population' on 'modified trains'. 1115

PIS visual displays shall be readable under both natural light and artificial lighting. 1116

The passengers-facing elements of mounting PIS visual displays shall avoid glare and reflections. 1621

The means of fixing PIS visual displays shall afford a degree of protection of IP66 to BS EN 60529 against ingress of dust and water into the equipment and its surround. 1612

PIS loudspeaker installations shall protect the loudspeakers from pressure, pulses, condensate and tunnel dust. 1539

Note: refer to the Environmental Context Document

10.10.4 CCTV integration

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

CCTV cameras shall be incorporated into the saloon as concluded by the Feasibility Investigation. 1120

CCTV cameras shall be protected from vandalism such that functionality of the camera is not inhibited. 1118

Note: This includes the ability to clean or replace any protection devices easily.

10.10.5 LED lighting integration

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

On 92TS (W&C), LED luminaires shall be incorporated into the saloon within the existing space envelopes. 1823

On 92TS (Central), LED luminaires shall be incorporated into the saloon in the locations determined following the Feasibility Investigation. 1829

The existing fluorescent tubes, inverters and diffusers shall be removed. 1830

10.11 Passenger and train operator environment

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

'Modifications' shall be designed and maintained so that the safety and comfort of the passengers and 'train operators' is ensured as far as is reasonably practicable under:

- (a) normal operating conditions;
- (b) abnormal conditions such as:
 - (i) derailments
 - (ii) equipment failure
 - (iii) heavy shunts
 - (iv) collisions with other trains or infrastructure

'Modifications' shall maximise interior passenger space as far as reasonably practicable. 870

'Modifications' shall be consistent with the aesthetics of 'unmodified trains' and the Aesthetic Concept.	☑☑☑ 885
'Modified trains' shall contain the same number of 'priority seats' and in the same locations as 'unmodified trains'.	☑☑☑ 1152
Removal of seating shall only be acceptable where replaced by 'wheelchair spaces'.	☑☑☑ 53
There shall be a space of at least 300mm horizontally in front of each seat cushion that extends for the full height and width of the seat.	☑☑☑ 60
'Modified trains' shall have at least the same area for commercial advertising as 'unmodified trains'.	☑☑☑ 63
'Modifications' shall not provide resting places for 'litter', so far as is reasonably practicable.	☑☑☑ 884
'Exposed surfaces' shall not give passengers access to, or visibility of, items that are not intended for passenger use.	☑☑☑ 886
'Modifications' shall not give passengers access to spaces which may be used for hiding, or disposing of, objects.	☑☑☑ 62
Note: The intention is to prevent the accumulation of combustible items, such as paper tickets (85mm x 54mm x 0.2mm), as well as the hiding of malicious devices.	
'Exposed surfaces' shall be suitable for the application and removal of vinyl film.	☑☑☑ 1144
Note: The 'purchaser' sometimes uses vinyl film as an alternative to repairing paint, following heavy graffiti damage.	
Heat output resulting from operation of the train or any train system shall not cause 'exposed surfaces' to exceed a temperature of 50°C.	☑☑☑ 866
'Exposed surfaces' shall require no routine maintenance other than cleaning and the renewal of surface coating.	☑☑☑ 891
'Exposed surfaces' shall: (a) be free from sharp edges and projections (b) not be made of materials that may fracture and reveal sharp edges or potentially injurious materials, inserts or inlays (c) be capable of deforming in a controlled manner to absorb secondary impact energy	☑☑☑ 947
Labels and signs in 'unmodified trains' shall be retained, if appropriate, in 'modified trains'.	☑☑☑ 1154

Equipment intended for passenger operation shall be labelled to indicate the functionality of, and how to operate, the equipment. ☑☑☑ 55

Note: This does not include handrails, seats or 'exposed surfaces'.

Adhesive signs and labels shall adhere effectively and resist unauthorised removal. ☑☑☑ 48

'Modified trains' shall maintain the display of unique car numbers in accordance with 1-382 Train decor design, as follows: ☑☑☑ 6
(a) Inside the saloon at both ends
(b) Inside the car at the driving position

Brake cylinder pressure gauges shall be visible to a 'train operator' in the saloon of every car. ☑☑☑ 37

10.12 Car interior equipment and systems

Requirement Text

721'S
921'S (Central)
921'S (W&C)
Req ID

'Modifications' shall take account of reasonably foreseeable variation in carbody build, including, but not limited to: ☑☑☑ 38
(a) Car dimension tolerances
(b) Vehicle condition

Existing equipment in 'modified trains' shall be: ☑☑☑ 4
• located
• functioning, and
• accessed
in the same manner as in 'unmodified trains'.

Note 1: If change is required, it shall be agreed with the 'LU Engineer'.

Note 2: it shall be agreed with the 'LU Engineer' which equipment shall be relocated to accommodate wheelchair spaces.

The colour of the 'coated surfaces' of 'modifications' shall be in accordance with the Aesthetic Concept. ☑☑☑ 2121

'Modifications' with 'moveable interfaces' shall be designed such that removable parts can be removed and replaced without removing the door leaves. ☑☑☑ 93

- Should the ventilation system be modified, it shall provide: ☑☑☑ 1155
 (a) The same air flow rates per passenger as 'unmodified trains' in both normal and emergency conditions, when the train is 'crush laden'
 (b) Natural ventilators with a minimum effective area of 0.3m² per car
 (c) Protection against the trapping of dust in the ventilation system, such that changes in flow rate do not transfer dust to the saloon
- The heating system in a 'modified car' shall provide the same heat output as the heating system in an 'unmodified car'. ☑☑☑ 1156
- The heating system in a 'modified car' shall provide the same heat distribution as the heating system in an 'unmodified car', so far as is reasonably practicable. ☑☑☑ 1158
- Should the pneumatic system be modified, it shall be proven that the modifications have no adverse effect on the performance of the pneumatic system or any train functionality. ☑☑☑ 36
- Should the saloon door open and close valves be relocated, the orientation of the saloon door open and close valves on 'unmodified trains' shall be maintained in 'modified trains', so that they do not operate in the event of sudden changes in longitudinal motion, e.g. braking or collision. ☑☑☑ 82
- Pneumatic isolating cocks shall: ☑☑☑ 39
 (a) Be visible under normal and emergency lighting conditions
 (b) Be clearly labelled with the function of the cock
 (c) Clearly indicate whether the cock is open or closed
 (d) Operate through a nominal angle of 90 degrees
- Pneumatic isolating cocks shall be accessible to the 'train operator'. ☑☑☑ 40
- There shall be a clear indication when a pneumatic isolation has been made, if that isolation is undetectable during routine maintenance. ☑☑☑ 41

10.13 Car structures and dynamics

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

- 'Modified trains' shall comply with the kinematic limits for the routes they are required to take, as defined by S1156. ☑☑☑ 8
- The change in 'crush laden' mass between 'modified trains' and 'unmodified trains' shall not negatively impact traction and braking performance. ☑☑☑ 35

- Should the mass of 'modified trains' exceed that of 'unmodified trains', or the mass distribution change, sufficient evidence to confirm that the additional mass will have no adverse effect on structural integrity or train performance shall be supplied to the 'purchaser'. 406
- Should the mass distribution of 'modified trains' differ significantly from the mass distribution of 'unmodified trains', sufficient evidence to confirm that the different mass distribution will not adversely affect the swept envelope, ride and stability of the 'modified train' shall be supplied to the 'purchaser'. This shall be achieved by dynamic modelling techniques, such as the use of VAMPIRE® software. 407
- 'Modifications' shall take account of reasonably foreseeable variation in all influences on structural integrity, including, but not limited to: 952
- (a) Car dimension tolerances
 - (b) Car mass tolerance
 - (c) Loading asymmetry
 - (d) Vehicle maintenance
 - (e) Vehicle condition
- The structural integrity of the 'modified train' and all 'modifications' shall be proven to be structurally fit for purpose in accordance with section 3.10 of S1180 by Finite Element Analysis and/or other suitable calculation method dependent on the extent of modification. Where applicable, analysis shall be in accordance with Appendix B / section 16.1. 408
- Equipment attachments shall withstand fatigue loading in accordance with BS EN12663-1 section 6.7.3. Longitudinal equipment inertia accelerations of at least +/-0.2g for 10^7 cycles (BS EN 12663-1 Table 18) shall apply. 2106
- All items of train-mounted equipment shall remain securely attached under normal operating conditions and as far as is practicable, during collisions or derailments. 2122
- In order to avoid undesirable responses, the fundamental modes of vibration of 'modifications' and 'supplied equipment' fitted on bracketry provided by the 'designer' in all operational conditions, shall be: 1616
- (a) separated sufficiently, from the modes of vibration of the car body structure and suspension, or
 - (b) otherwise decoupled, from the modes of vibration of the car body structure and suspension
- Where 'modifications' include the following items, they shall, where possible, be attached directly to the carbody structure: 957
- (a) Interior panels
 - (b) Ceiling mounted equipment
 - (c) Wall mounted equipment

<p>'Modifications' shall, where practical, use existing means of fixing to the carbody, including: (a) Holes on 'unmodified trains' (b) Types of fastener in use on 'unmodified trains'</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 413</p>
<p>The 'designer' shall demonstrate that the number and size of new holes required in the 'modified train' carbody structure are as low as possible.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 1614</p>
<p>The effect of all mounting holes and brackets, access holes and other stress concentrating features shall be assessed.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 2123</p>
<p>The position of all 'modifications' mounted outside the 'unmodified train' exterior space envelope shall be subject to a gauging assessment in accordance with S1156, to confirm that the kinematic limit is not exceeded.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 416</p>

11. DESIGN PRINCIPLES REQUIREMENTS

11.1 General

Requirement Text	72TS 92TS (Central) 92TS (W&C) Req ID
<p>'Modifications' shall fulfil all requirements specified in this TRS for a 'design life' of 30 years.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 3</p>
<p>'Modified units' and 'unmodified units' shall be able to be coupled together and operated as a train.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 651</p>
<p>Any 'modifications' shall not impact on the remaining life of the vehicle or other equipment.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 1615</p>
<p>'Modified trains' shall comply with all relevant LU, Railway Group, national, European and international standards, and applicable legislation so far as is reasonably practicable.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 5</p>
<p>'Modifications' shall be compliant with S1180, and shall be proven in accordance with S1538.</p>	<p><input checked="" type="checkbox"/><input checked="" type="checkbox"/><input checked="" type="checkbox"/> 67</p>

11.2 Mechanical

Requirement Text	72TS 92TS (Central) 92TS (W&C) Req ID
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- 'Modifications' shall be designed to take into account the consequences of mechanical failure. The risk of mechanical failure shall be reduced, where appropriate, by measures such as the: ☑☑☑ 410
- (a) Over-design of mountings and attachments
 - (b) Use of fasteners incorporating high strain energy
 - (c) Provision of:
 - (i) Emergency or secondary security
 - (ii) Alternative load paths
- Any 'modification' subject to repetitive movement shall be designed to accommodate such movement over the required component life. ☑☑☑ 415
- Where different materials within the 'modified train' are joined or in contact, appropriate measures shall be taken to avoid corrosion. ☑☑☑ 418
- All 'modifications' which are electrically conductive shall be bonded to the carbody earth to prevent the development of touch potentials and allow fault currents to be accommodated. ☑☑☑ 419
- All 'fixed interfaces' shall be designed and secured to ensure that joint integrity and security does not degrade over the design life. ☑☑☑ 420
- All 'fixed interfaces' shall be designed so that secondary security is not necessary. ☑☑☑ 421
- 'Moveable interfaces' shall be provided with secondary security, if failure of the primary security could lead to: ☑☑☑ 411
- (a) the kinematic limit being exceeded;
 - (b) components intruding the saloon beyond their intended positions;
 - (c) an increase in safety risk above a level that is as low as reasonably practicable.
- Design features providing secondary security used at 'moveable interfaces' shall carry the transferred load in the event of failure of the interface. ☑☑☑ 422
- 'Moveable interfaces' shall be designed to be easily dismantled, particularly when specialised fixing arrangements are used. ☑☑☑ 433
- All 'modifications' that are attached to the train with a 'moveable interface' and that are completely above a horizontal plane that is 100mm below the top of the saloon body side windows, except handrails, shall be provided with secondary retention lanyards. ☑☑☑ 960
- Note:** Such items may include interior panels, advert panels, electronic displays, luminaires, loudspeakers, ventilation grilles, cameras.

- Each secondary retention lanyard shall be capable of retaining its connected item under the following conditions: 966
- (a) Falling from its normal position
- (b) Subject to the accelerations and inertia forces detailed in Appendix B / Section 16.1 and such that any electronic equipment is retained by the lanyard, not by its electrical wiring
- Where the failure of secondary security may cause personal injury, that secondary security shall not use load paths parallel to the primary security. 423
- Secondary security shall provide protection from the consequences of failure of the corresponding primary security until at least the next scheduled maintenance inspection of the primary security. 424
- Visual inspection of secondary security shall be possible during 'routine maintenance' and any deviation from correct installation shall be visually apparent. 425
- In the event of failure of primary security, engagement of the corresponding secondary security shall draw attention to itself. 426
- Where resilient mountings are used within the 'modified train', mounted equipment shall remain secure and within gauge in the event of failure of 50% of the resilient mountings. 427
- The surface finish, condition, coating and any necessary preparation of all mating surfaces, both within and to 'modifications' shall be specified. 428
- Welding on any 'modifications' shall comply with BS EN 15085, Parts 1 to 5. 429
- Fasteners selected for interfaces within and to 'modifications' shall be appropriate for their intended application, being capable of being reliably installed and maintained with minimum tooling costs. 430
- 'Modifications' shall use minimal number of fastening and locking methods, favouring those already used in other locations on the vehicle. 431
- All fasteners in 'modifications' shall be fitted with a vibration-resistant locking arrangement. 434
- Where composites or plastic materials are used in 'modifications', appropriate steps shall be taken to ensure that creep of the material does not degrade the performance of the joint. Load bearing washers, positive mechanical locking or other means of ensuring the integrity of the joint shall be used, as appropriate. 435
- 'Moveable interfaces' shall not require the use of adhesives or chemical compounds (e.g. Loctite). 436

- The following shall be specified for all fasteners used in 'modifications': 437
- (a) Type
 - (b) Geometrical features, including any threads, head shape, shank form, end form and driving feature
 - (c) Dimensions and tolerances, including threads for threaded fasteners
 - (d) Material specification
 - (e) Mechanical properties, e.g. property class for steel fasteners
 - (f) Surface finish
 - (g) Component part specifications, e.g. washers, nuts, collars
 - (h) Locking method(s)
 - (i) Tooling
 - (j) Installation procedure, including any lubrication specification
 - (k) Installed configuration, including torque or preload setting
 - (l) Maintenance instructions
 - (m) Reusability criteria

Note: The following standards are useful in fulfilling this requirement:
BS ISO 1891, BS EN ISO 1891-2, BS EN ISO 14588, BS 3692, BS 7776,
BS 6416, ISO 1703, BS ISO 5391.

Threaded fastener torque settings shall be the same for all threaded fasteners of a given specification. 438

A flat washer shall be used under rotated surfaces in bolted joints when the underlying material being clamped would otherwise be damaged. 439

Fitted bolts shall not be used. 440

Where suitable, bolts and screws used in 'moveable interfaces' shall be BS 3692 grade 8.8 and nuts shall be BS 3692 grade 8. 441

Where bolts and screws in 'moveable interfaces' are required to be a higher grade than 8.8, it shall be clearly stated whether or not the fastener components are reusable and, if so, under what re-use conditions. 442

The use of threaded fasteners of the same size, but of different grades, shall be avoided. 443

The preferred standard sizes of threaded fasteners shall be as specified by BS 3692 and shall be part of the coarse pitch series with a medium class fit. 444

Threaded fasteners shall not be directly inserted into aluminium, aluminium alloys, plastics or composites. In such cases, the holes shall be fitted with suitable threaded inserts. 445

- The use of locking compounds on threaded fasteners shall be avoided, where possible, and may only be used after specific approval has been given by the 'purchaser' for each application. For approval to be given, all of the following conditions must be fulfilled: 446
- (a) The joint does not contribute to the structural integrity of the vehicle, equipment, or mounting arrangement.
 - (b) The fastener cannot be locked solely by mechanical methods.
 - (c) Disturbance is likely to be infrequent, i.e. only for repair, and never for 'first line maintenance'.
 - (d) The threaded fasteners shall all be renewed after dismantling. If this cannot be achieved, e.g. threaded holes in large components, a method to clean the threads must be given which is effective and assured.
 - (e) The cleaning methods and materials have been documented and process instructions supplied to the 'purchaser'.
 - (f) Full instructions for the use of each compound proposed, its handling, disposal and safety implications are supplied to the 'purchaser'.
- Bonded joints between similar materials shall only be considered for 'fixed interfaces'. 447
- Interfaces between dissimilar materials, e.g. metal bonded to rubber, shall be treated as 'moveable interfaces' even if they are intended to be 'fixed interfaces'. 448
- Equipment enclosures shall provide ingress protection to at least BS EN 60529 IP65. 450
- Seals in 'modifications' shall maintain their performance when subjected to the expected number of opening and closing cycles forecast for the 'design life'. 451
- Equipment enclosures shall permit dismantling and repair of the enclosed equipment, except when it is proven that permitting such access will result in a greater whole life system cost. 453
- The 'LU Engineer' and 'designer' shall agree on what items are 'Line Replaceable Units' ('LRUs'). 'LRUs' shall comply with the requirements in appendix B / Section 16.2. 449

11.3 Materials

11.3.1 General

Requirement Text

Materials used shall be fit for purpose and suitable for the environment in which they shall be used. 42

Note: See Environmental Context Document

7ZTS
9ZTS (Central)
9ZTS (W&C)
Req ID

- Materials used shall be resistant to damage that can be caused by: 43
- (a) Cleaning products and processes
 - (b) Graffiti and gum removal products and processes
 - (c) Maintenance products and processes
 - (d) Other substances that may be found on the LU railway
- Materials used shall maintain safety and health risks to be ALARP. 650
- Hazardous materials in 'unmodified trains' shall not be disturbed in order to incorporate the 'modifications'. 2111
- The use of every hazardous material shall be justified to, and agreed with the 'LU Engineer'. 1184
- The effects of paint, sealant and other material drying and curing times on overall process efficiency shall be considered as part of material selection. 2183
- Glass used shall: 45
- (a) Withstand passengers leaning against it
 - (b) Have exposed edges adequately protected or treated
- Glass used in shall not be used to prevent unintended operation of mechanisms, controls or equipment. 46
- Glass used shall be laminated if used in the following applications: 47
- (a) Luminaires
 - (b) Draught screens
 - (c) Internal fittings located above the tops of the car windows

The durability of 'coated surfaces' shall be in accordance with the test requirements below:

2124

Test Parameter	Test Method	Test Requirements
Scratch Resistance (all substrates)	BS EN ISO 1518-1:2011	No penetration of the dry film using a 2.5 Kg load.
Flexibility / Bend Test (Cylindrical Mandrel) (Steel and aluminium substrates only)	BS EN ISO 1519: 2011	No cracking flaking or detachment from the substrate when using a 6mm diameter mandrel.
Adhesion Resistance - Cross Cut (all substrates)	BS EN ISO 2409: 2013	The degree of damage shall not exceed Grade 1 for interior and exterior general purpose and Grade 0 for interior High Durability. For re-coating these grades are 2 and 1 respectively.
Impact Resistance (all substrates)	BS EN ISO 6272-1: 2011	No cracking flaking or detachment from the substrate when a 1 kg weight is dropped from a height of 40 cm.
Abrasion Resistance (all substrates)	BS EN ISO 7784-1: 2006	The weight loss is not to exceed 30 mg after 500 cycles using a CS10 wheel.
Resistance to Humidity	BS EN ISO 6270-1	No softening, swelling, blistering or under-film corrosion after 2000 hours of cycling.
UV Lightfastness (all substrates)	BS EN ISO 11507: 2007 Method A Exposure including condensation	No cracking, flaking, blistering, loss of inter-coat adhesion or change in colour
Chemical Resistance (all substrates)	BS EN ISO 2812-4:2007	Paint system shall suffer no adverse effects after 24 hours exposure to chemical agents
Resistance to corrosion	Part F4 of BS 3900 for a period of 1000 hours.	Two lines approximately 50 mm in length and intersecting at right angles in the centre of the 100 mm x 150 mm panel are cut through the coating to the substrate using a sharp knife. The scribed area shall be subjected to a tape pull-off test, using Scotch 898 or equivalent tape. There shall be no signs of corrosion or blistering on the undamaged portions of the panel. Additionally there shall be no material loss beyond 2mm from the scribed lines.

11.3.2 Fire safety performance

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

'Modifications' shall fulfil the requirements of BS 6853 for Category 1a vehicles.

865

Note: other Fire Safety Performance requirements in this TRS are in addition to the requirements of BS 6853.

'Technical liquids', including electrical components, used in 'modifications' shall be subject to a fire risk assessment, carried out in accordance with G085.

495

Flat surfaces requiring fire testing shall be subject to toxic fume test B2 in Annex B of BS 6853, having a mass of combustible material (as opposed to inert substrate) of not less than 5g, or (if this mass is impractical) scaled by mass from a B1 test, the latter including sampling of the toxicity of the gases liberated. ☑☑☑ 1039

Where the use of non-compliant materials in 'modifications' is unavoidable, the fuel load density shall be restricted by limiting use to the minimum required. ☑☑☑ 500

Individual items of equipment shall be subjected to fire tests unless:
(a) there is an existing, valid entry in the 'approved products register' which is applicable for the specific item and its proposed application, or
(b) the items are contained within a container with an adequate degree of fire resistance as defined by BS 6853 ☑☑☑ 502

Fire testing on coated and composite materials used in 'modifications' shall be undertaken on the complete assembly. ☑☑☑ 499

Where a degree of fire resistance is claimed for a container, it shall be subjected to fire testing sufficient to validate the fire resistance. ☑☑☑ 503

11.4 Environment

11.4.1 General

Requirement Text

72/TS
92/TS (Central)
92/TS (W&C)
Req ID

'Exposed surfaces' shall be graffiti resistant in accordance with type test LU-RSE-T001. ☑☑☑ 859

'Exposed surfaces' shall be liquid resistant in accordance with type test LU-RSE-T002. ☑☑☑ 862

The interaction of 'modified trains' with external systems shall be no worse than 'unmodified trains'. At least the following shall be considered: ☑☑☑ 7
(a) LU's neighbours, including adjacent railways
(b) Railway systems under all credible operating and fault conditions, including adjacent railways
(c) Generation and emission of particulates, liquids and heat
(d) Generation of noise
(e) Generation of shock and vibration by the movement of modified trains
(f) Electromagnetic compatibility

- 'Modifications' shall not be damaged by a change in ambient temperature of 3 degrees Celsius per second sustained for 13 and a 1/3 seconds, over any range within the ambient temperatures defined in the Environmental Context Document. 566
- For equipment in locations where the ambient temperature range is exceeded, the actual temperatures occurring at the location of the equipment concerned shall be used in the design. 567
- Following 60 hours 'powered down' at -15 degrees Celsius, the 'modifications' shall function to this TRS and support compliance of the 'supplied equipment'. 568
- The 'modifications' shall function, and support the 'supplied equipment' to function, to this TRS following a period installed on the vehicle but 'powered down' for up to (and including) 60 weeks. 569
- The 'modifications' shall be designed for, and shall support compliance of the 'supplied equipment' for, a yearly average humidity stress of no less than 75% relative humidity over the ambient temperature range specified by the Environmental Context Document. 570
- The 'modifications' and 'supplied equipment' shall be designed for a humidity stress lasting 30 consecutive days per year of no less than 95% relative humidity over the ambient temperature range specified by the Environmental Context Document. 571
- For equipment in locations where additional environmental factors are present, the design and manufacture of these components shall take the environmental conditions in BS EN 50125-1 and the Environmental Context Document into account. 574
- Equipment enclosures and cases shall take into account temperature rises within them to ensure that the enclosed equipment does not exceed its specified temperature rating, in accordance with section 4.1.2 of BS EN 50155. 575
- Where environmental protection of the 'supplied equipment' is provided by 'modifications', protection shall be provided against the ingress of foreign material and items described in the Environmental Context Document. 576
- Underfloor equipment and services shall be designed to avoid the accumulation of dirt and tunnel dust. 580
- The means of protection of 'supplied equipment' against ingress of solids and liquids shall last for the design life without harmful degradation in function. 582

The means of protection of 'supplied equipment' against ingress of solids and liquids shall be repairable on a casualty basis, requiring replacement of only those components that directly form the protection system (i.e. seals shall be replaced independently of case covers). ☑☑☑ 583

11.4.2 Noise shock and vibration

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

'Modifications' shall not resonate, vibrate or emit any noticeable sound in normal service conditions. ☑☑☑ 579

'Supplied equipment' shall be adequately supported such that it shall not resonate, vibrate or emit any noticeable sound in normal service conditions. ☑☑☑ 869

'Modifications' shall be able to withstand, without deterioration, vibrations and shocks that occur in service on the routes the 'modified trains' are required to operate. ☑☑☑ 586

11.5 RAM

11.5.1 Maintainability

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

Identification of the degradation of 'modified trains' before failure occurs shall be at least as easy as the identification of degradation of 'unmodified trains'. ☑☑☑ 10

Access panels and equipment cupboard design shall minimise time required for diagnosis and repair of 'modifications' and 'supplied equipment'. ☑☑☑ 11

On 72TS, the durations for the following maintenance shall not be extended following the implementation of the 'modifications': ☑☑☑ 2107

- Level 01 – Train Preparation (every 24 hours)
- Level 02 –Examination (every 28 days)
- Level 03 – Shed day (every 26 weeks)
- Level 04 –Programme Lift (every 2.5 years)

- On 92TS (Central) and 92TS (W&C), the durations for the following maintenance shall not be extended following the implementation of the 'modifications': ☒☒☒ 607
- Level 01 – 24 Hourly Inspection
 - Level 02 – 28 Daily Examination
 - Level 03 – Annual Modular Maintenance
 - Level 03 – Annual Door Maintenance
 - Level 03 – Annual heat and ventilation check
 - Level 04 – 6 Yearly Programme Lift
- The amount of dismantling and disturbance required to maintain 'modified trains' shall be no greater than for 'unmodified trains'. ☒☒☒ 12
- Fixings for inspection panels, covers and other means of access in 'replacement systems' shall be by authorised quick release. ☒☒☒ 14
- Note:** Use of a J-door key (LU drawing 100524) is the most common method for ensuring quick release by authorised persons only, as all operational staff are issued with a key. See LU drawing 52544 for details of the standard J-door lock.
- Incorrectly secured means of access in 'modifications' shall be easily identifiable. ☒☒☒ 15
- 'Modifications' shall minimise the opportunity for maintenance errors. ☒☒☒ 16
- Maintenance and cleaning of 'modified trains' shall only require tools, equipment and materials which are commonly available to maintainers and cleaners at maintenance and cleaning locations. ☒☒☒ 17
- 'Modifications' shall minimise the trapping of dirt. ☒☒☒ 854
- 'Modifications' shall facilitate cleaning. ☒☒☒ 858
- Access to maintainable components adjacent to 'modifications' shall not be compromised by the installation of new or modified components on the 'modified train'. ☒☒☒ 417
- If the installation of the 'modifications' requires any changes to the existing train maintenance regime, the 'designer' shall review all maintenance tasks carried out and ensure all affected tasks can be carried out by alternative means with no addition to the overall maintenance load, including without limitation in terms of maintenance intervals, duration or resource levels. ☒☒☒ 608
- It shall be possible for 'maintenance staff' to replace, on the train, any 'LRU' within 30 minutes, such that it is in an operational state. ☒☒☒ 610
- All items not requiring 'routine maintenance' shall be separated from equipment requiring 'routine maintenance' as far as reasonably practicable. ☒☒☒ 611

All 'modifications', which are identical in functionality, shall be physically interchangeable. ☑☑☑ 614

All 'modifications', which are visually similar, but have different operating functionality, shall not be interchangeable. ☑☑☑ 615

No 'special tools' shall be required for 'first line maintenance' of the 'modifications'. ☑☑☑ 616

11.6 Safety

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

Safety risk due to 'modifications' shall be as low as reasonably practicable. At least the following shall be considered in the design: ☑☑☑ 19

- (a) All operating conditions, including when powered down
- (b) All credible fault conditions
- (c) All maintenance and cleaning conditions
- (d) Interfaces with other railway systems
- (e) Neighbours, including adjacent railways
- (f) Passenger detrainment
- (g) During and after all credible accident conditions, including:
 - (i) Arcing
 - (ii) Collision between trains
 - (iii) Collisions other than between trains
 - (iv) Derailment
 - (v) Explosion
 - (vi) Passenger train interface (PTI)
 - (vii) Power failure
 - (viii) Train fire
 - (ix) Insufficient ventilation
- (h) Vandalism by passengers or trespassers

11.7 Human factors

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

'Modifications' shall be suitable for use by and for interaction with 'passengers' and 'maintenance staff' within the 'reference population'. ☑☑☑ 871

'Modifications' shall be suitable for use by those outside of the 'reference population', so far as is reasonably practicable. ☑☑☑ 872

'Modifications' shall be resistant to tampering, vandalism and unauthorised removal. ☑☑☑ 61

- 'Modifications' shall not include holes or gaps between fixed or moveable parts that could cause injury by trapping body parts, including finger traps, and shall protect against entrapment in accordance with section 4.2.7 of BS EN 1176-1:2008. ☑☑☑ 873
- All interactions between the following user groups and 'modifications' shall be identified and subjected to Human Factors analysis and design activities as part of the design development process, in accordance with S1217: ☑☑☑ 23
- (a) Passengers, including those with impairments and disabilities
 - (b) Train operators, including shunters
 - (c) Train maintainers and engineers
 - (d) Station staff
 - (e) LU Emergency Response Unit
 - (f) Emergency services
- Designs of 'modifications' shall take into account the clothing typically worn by the user groups. ☑☑☑ 874
- Human factors analyses shall consider at least the following conditions: ☑☑☑ 875
- (a) Normal operation of the railway
 - (b) Degraded operation of the railway
 - (c) All times of the day and night
 - (d) All climatic conditions
 - (e) Emergencies, including:
 - (i) Detrainment
 - (ii) Coupling
- Human factors analyses shall consider the variation in at least the following aspects of staff performance: ☑☑☑ 880
- (a) Competence
 - (b) Experience
 - (c) Reliability
 - (d) Ease of access to required information
- 'Modifications' shall be safe and shall maximise staff performance during, but not limited to, the following tasks: ☑☑☑ 652
- (a) Recovery from a 'modification' failure during service
 - (b) Routine (planned) maintenance tasks
 - (c) Fault finding, including the connection and use of diagnostic equipment
 - (d) Repair (unplanned) maintenance tasks
- The likelihood that staff or passenger interaction with the 'modifications' will result in a delay to the train service shall be minimised. ☑☑☑ 878

11.8 Manufacturability

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

Design and materials selection shall consider whole life cost. 2110

Ease and efficiency of manufacture shall be considered throughout the design process. Prospective manufacturers shall be consulted and the 'designer' shall provide evidence that all proposed designs are suitable for large-scale production, which can be competitively tendered. 2113

11.9 Installation processes

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

The installation processes shall be suitable for implementation in a large train modification work shed on up to 5 trains at a time. 1577

The installation processes shall be suitable (or easily adaptable) for implementation in an operational train maintenance depot. 2184

Ease and efficiency of the installation processes shall be considered throughout the design process. 1578

The installation processes shall be safe to implement (with reasonable levels of PPE) and hazardous or dusty materials or waste must be adequately controlled. 1574

The installation processes shall utilise tooling and equipment that can be easily moved between different cars around the work site. 1575

The installation processes, where practicable, shall be resilient to the dusty and potentially cold and damp environment in and around a rolling stock maintenance shed. 1576

The installation processes shall consider the need to complete multiple activities in parallel by the minimising the disruption to any other activities (in other areas of the same train or adjacent trains). 1579

It shall be possible for an operative to perform the installation processes for the duration of a 12-hour shift without Health and Safety or Human Factors issues. 1580

The installation processes shall utilise tooling and equipment that shall require minimal maintenance throughout the period of implementation works across all fleets. 1581

11.10 'Supplied equipment' installation

Requirement Text	72TS 92TS (Central) 92TS (W&C) Req ID
Electrical installations, including cabling, shall comply with BS EN 50343. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1632
Electrical connections to equipment shall be designed to minimise the risk of damage during installation, operation and maintenance. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1633
Cables shall be secured in such a manner as to avoid damage being sustained to the cables – e.g. over tightened cable ties. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1681
Cable ties shall not be used to secure underframe cables. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1682
Underframe cables shall, where practical, be protected with conduit. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1686
Underframe cables which are not mechanically protected, shall be located where they are unlikely to sustain damage from ballast etc. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1687
Cables mounted on the underframe shall be installed within the existing cable ducts or new conduits. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1699
Underframe conduit shall be supported at intervals of no more than 500mm using conduit clamps recommended by the conduit manufacturer as suitable for the operating environment. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1700
Wiring which could be subjected to flexing or underframe cables shall be provided with suitable cleats, conduit clamps, sheaths or supports adjacent to the terminations and at suitable locations along its route. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1683
Cable looms or harnesses shall not be self-supporting. Note: this shall be achieved in collaboration with the 'supplier(s)'.	☑☑☑ 1692

Cables shall not rely on their termination for mechanical support. 1693

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Cables installed in the vehicle interior, other than those running within conduits, shall be secured by means of non-metallic cable ties or suitable cable clips at intervals of no greater than 250mm, or 100mm for routing of cable at terminal rail positions where individual cables are spurred of connections to terminal posts. 1694

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Cable bundles within ducts shall be secured with approved non-metallic ties at intervals not exceeding 300mm. 1696

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Self-adhesive cable supports shall not be used. 1697

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Any spare or redundant cables shall be individually insulated and securely restrained so that they cannot move or come into contact with any terminal or structure. 1698

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Where lubrication is required to be used to install cables into ducts or conduits, only lubrication specifically for that purpose shall be used. 1701

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Where lubrication is required to be used to install cables into ducts or conduits, the lubricant shall neither contaminate any termination or equipment, nor have any long term detrimental effect on the cable or conduit. 1702

Note: this shall be achieved in collaboration with the 'supplier(s)'.

All metal parts not intended as circuit conductors shall be bonded to the vehicle body to prevent them developing a potential difference relative to the vehicle structure. This requirement does not apply to metal parts which are protected by an approved system of secondary insulation. 1758

Note: this shall be achieved in collaboration with the 'supplier(s)'.

The installation of the 'supplied equipment' shall avoid the creation of earth loops. 1759

Note: this shall be achieved in collaboration with the 'supplier(s)'.

The 'supplied equipment ' shall be earthed to existing earth locations on the vehicle structure. 1767

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Labels and safety signs on 'supplied equipment' shall not be visible to passengers. 1770

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Cables shall be routed in a manner to minimise the effects of EMI using best industry practise. 1641

Note: this shall be achieved in collaboration with the 'supplier(s)'.

The installation of the 'supplied equipment' shall be arranged so as to reduce, as far as possible, the effects of external electrical disturbances. 1798

Note: this shall be achieved in collaboration with the 'supplier(s)'.

Access to terminals, components and equipment of the 'supplied equipment' shall not be hindered by the installation of new wiring. 1690

Note: this shall be achieved in collaboration with the 'supplier(s)'.

12. DESIGN ACCEPTANCE

12.1 Overview

12.1.1 Figure 1 shows the design stages and reviews required. These are explained in Section 12.2.

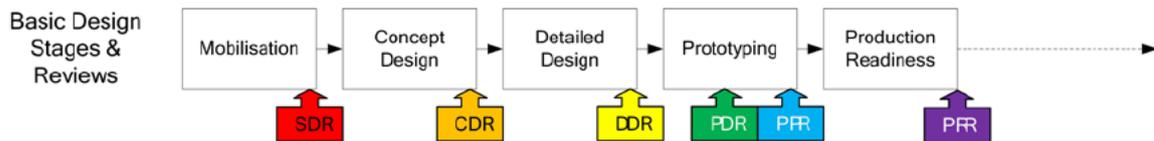


Figure 1: Design stages and reviews

12.1.2 Figure 2 shows an overview of these design stages together with the above and below wastrail workstreams and the inputs from the 'purchaser' (which will be from the 'supplied equipment' suppliers).

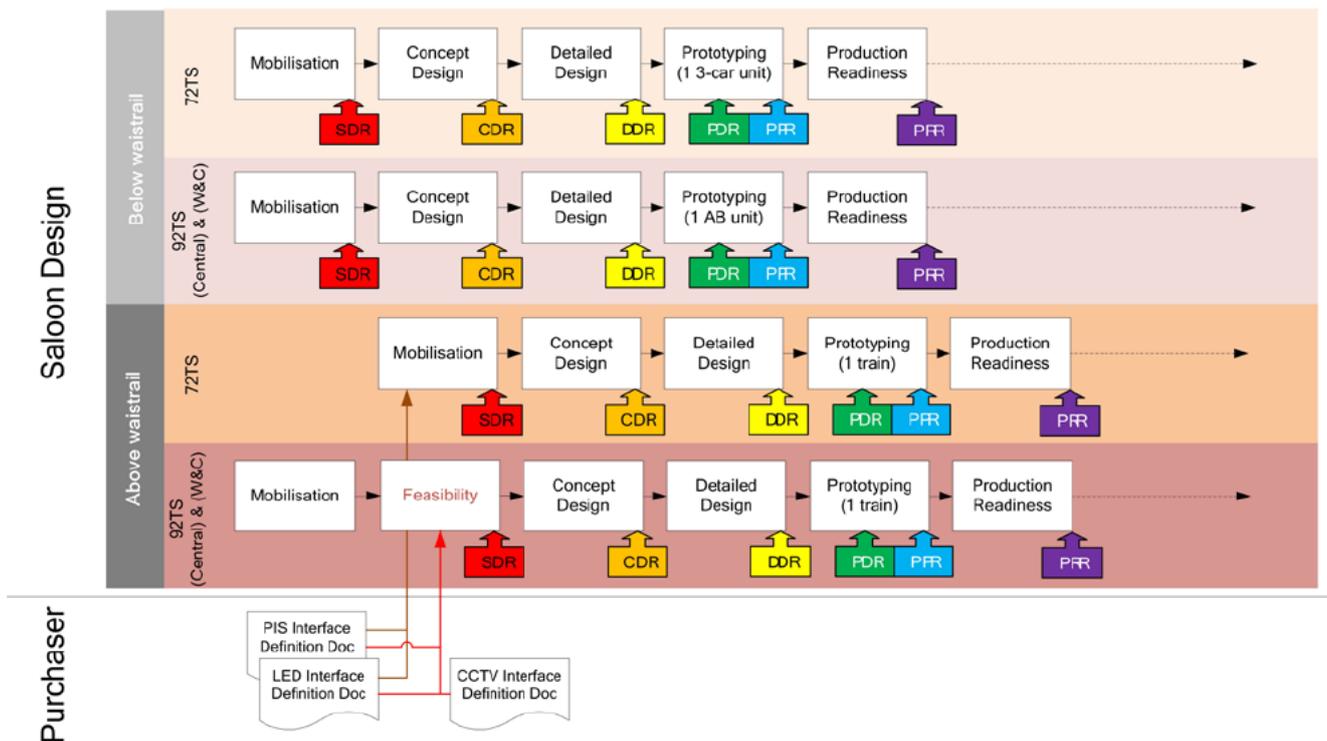


Figure 2: Overview of Design Approach for Saloon Design

12.2 Design review process

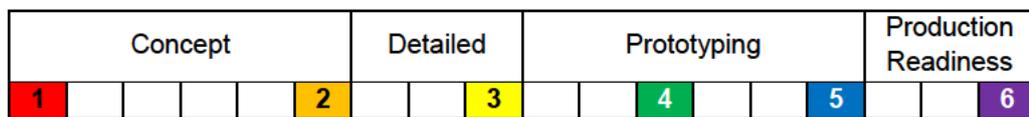
12.2.1 For each workstream (above and below wastrail), the design shall fall into four stages, with six design reviews as shown in Table 1.

Table 1: Required design reviews

Stage	Review	Initialism
Concept	1 Specification Design Review	SDR

	2	Concept Design Review	CDR
Detailed	3	Detailed Design Review	DDR
Prototyping	4	Prototype Design Review	PDR
	5	Post-Prototype Review	PPR
Production Readiness	6	Production Readiness Review	PRR

Time →



- 12.2.2 Design Reviews shall facilitate the raising, discussion and agreed action of issues that have arisen during the submission review period.
- 12.2.3 The 'designer' shall hold each Design Review and invite the 'purchaser'. All reviews shall be single gateway reviews. Each review may be held over a number of consecutive days.
- 12.2.4 The 'designer' shall provide documentary evidence prior to each Design Review, as detailed in the section relating to that Design Review, to demonstrate that the design will meet requirements and facilitate acceptance. These documents form the Design Review Submission.
- 12.2.5 The 'designer' shall provide meeting schedules and agendas to the 'purchaser' at least five working days before each Design Review.
- 12.2.6 The Design Review Submission shall be submitted to the 'purchaser' at least ten working days prior to the respective review date. Each submission shall include a clear explanation of the scope of the submission for that stage.
- 12.2.7 Each Design Review shall be minuted by the 'purchaser' such that the minutes, once agreed and issued to all parties, and all actions closed to the satisfaction of the 'purchaser', will form the agreed platform for project progression to the subsequent stage.

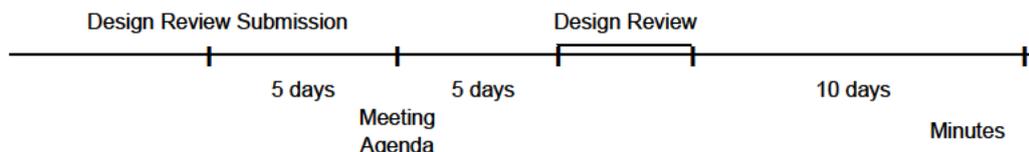


Figure 3: Timescales for each Design Review

- 12.2.8 Other review meetings shall occur as and when necessary. These shall be minuted by the 'purchaser'.

12.3 Specification Design Review (SDR)

12.3.1 The SDR shall be conducted to confirm to the 'purchaser's' satisfaction the adequacy of the 'designer's' translation of the TRS into the required suite of design products. The SDR will evaluate the initial design concepts developed to meet the requirements of the TRS, together with the engineering processes and analysis which underpin them. There shall also be detailed discussion of the interfaces with the supplier(s) of the 'supplied equipment'.

12.3.2 The SDR Design Review Submission shall include the following products.

ID	Product	Defined in paragraph
SDR_00	Feasibility Investigation Report	4.2
SDR_01	Engineering Plan	13.1.1
SDR_02	Requirements Management Plan	13.1.2
SDR_03	Risk Register	13.1.3
SDR_04	Interface Control Plan	13.1.4
SDR_05	Engineering Safety Management Plan	13.1.6
SDR_06	Quality Plan	13.1.7
SDR_07	Initial manufacturability and obsolescence management plan	13.1.8
SDR_08	Product Specification (PS)	13.1.9
SDR_09	Design Management and Assurance Plan	13.1.15
SDR_10	Weight Management Plan	13.1.17
SDR_11	Configuration Management Plan	13.1.18
SDR_12	Human Factors Integration Plan	13.1.20
SDR_13	RVAR Compliance Plan	13.1.22
SDR_14	RAM Strategy Plan	13.1.23
SDR_15	Initial Test Plan	13.1.24
SDR_16	Initial Prototype Production Plan	13.1.27

12.4 Concept Design Review (CDR)

12.4.1 The entry criteria for the CDR review is a completed SDR for which all actions have been closed to the satisfaction of the 'purchaser' and completion of the CDR Design Review Submission.

12.4.2 The CDR shall be conducted to evaluate the design concepts developed to meet the requirements of the TRS. The 'designer's' submissions shall provide sufficient information to demonstrate how the proposed concepts are likely to meet the requirements of the TRS, and that they will be fit for purpose. The CDR completes the Concept Design phase of works and allows the 'purchaser' to seek Approval in Principle (AIP) to progress to the detailed design phase.

12.4.3 The CDR Design Review Submission shall include the following products.

ID	Submission	Defined in paragraph
CDR_01	Updated Engineering Plan	13.1.1
CDR_02	Updated Risk Register	13.1.3
CDR_03	Updated Interface Control Plan	13.1.4
CDR_04	Interface Definition Documents	13.1.5
CDR_05	Completed Engineering Safety Management Plan	13.1.6
CDR_06	Updated Quality Plan	13.1.7
CDR_07	Updated manufacturability and obsolescence management plan	13.1.8
CDR_08	Concept PS	13.1.9
CDR_09	Concept replacement floor covering system product specification	13.1.10
CDR_10	Design Calculations	13.1.12
CDR_11	Declaration of design performance	13.1.13
CDR_12	Register of non-metallic components	13.1.14
CDR_13	Updated Configuration Management Plan	13.1.18
CDR_14	Initial human factors report	13.1.21
CDR_15	RVAR Compliance Matrix	13.1.22

CDR_16	Completed RAM Strategy Plan	13.1.23
CDR_17	Updated Test Plan	13.1.24
CDR_18	Updated Prototype Production Plan	13.1.27
CDR_19	Initial installation instructions	13.1.28
CDR_20	Training Matrix Plan	13.1.29

12.5 Detailed Design Review (DDR)

12.5.1 The entry criteria for the DDR review is a completed CDR for which all actions have been closed to the satisfaction of the 'purchaser' and completion of the DDR Design Review Submission.

12.5.2 The DDR shall be conducted to evaluate the detailed design developed to meet the requirements of the TRS. The 'designer's' submissions shall provide sufficient information to demonstrate that the 'modifications' design is complete, will meet the requirements of the TRS, and that it will be fit for purpose. Completion of the DDR signifies formal acceptance of the final design. Evidence provided by the 'designer' will enable the 'purchaser' to produce a compliance submission which will seek design acceptance and a Letter of No Objection which allows progress to the prototype phase of the project.

12.5.3 The DDR Design Review Submission shall include the following products.

ID	Submission	Defined in paragraph
DDR_01	Updated Engineering Plan	13.1.1
DDR_02	Updated Risk Register	13.1.3
DDR_03	Agreed Interface Definition Documents	13.1.5
DDR_04	Initial engineering safety management report	13.1.6
DDR_05	Updated quality plan	13.1.7
DDR_06	Updated manufacturability and obsolescence management plan	13.1.8
DDR_07	Detailed PS	13.1.9
DDR_08	Detailed replacement floor covering system product specification	13.1.10
DDR_09	Design calculations	13.1.12

DDR_10	Updated declaration of design performance	13.1.13
DDR_11	Updated register of non-metallic components	13.1.14
DDR_12	Initial Weight declaration	13.1.17
DDR_13	Configuration management plan	13.1.18
DDR_14	Updated human factors report	13.1.21
DDR_15	Updated RVAR Compliance Matrix	13.1.22
DDR_16	Initial RAM Report	13.1.23
DDR_17	Updated Test Plan	13.1.24
DDR_18	Prototype Test Specification	13.1.25
DDR_19	Updated Prototype Production Plan	13.1.27
DDR_20	Updated installation instructions	13.1.28
DDR_21	Initial Training Materials	13.1.29
DDR_22	Draft Maintenance documentation	13.3
DDR_23	Maintainability Demonstration Plan	13.1.32

12.6 Prototype Design Review (PDR)

12.6.1 The entry criteria for the PDR review is a completed DDR for which all actions have been closed to the satisfaction of the 'purchaser' and completion of the PDR Design Review Submission.

12.6.2 A PDR review shall be conducted to evaluate the readiness of the designs for prototype build and testing. The 'designer's' submission shall provide sufficient information to demonstrate that the prototype and testing plans are fit for purpose. Once all actions are completed to the 'purchaser's' satisfaction, prototype manufacture and testing can commence, and progression into the production design stage.

12.6.3 The PDR Design Review Submission shall include the following products.

ID	Submission	Defined in paragraph
PDR_01	Final Engineering Plan	13.1.1
PDR_02	Updated Risk Register	13.1.3

PDR_03	Updated Agreed Interface Definition Documents	13.1.5
PDR_04	Engineering safety management report	13.1.6
PDR_05	Updated quality plan	13.1.7
PDR_06	Updated manufacturability and obsolescence management plan	13.1.8
PDR_07	Prototype PS	13.1.9
PDR_08	Prototype replacement floor covering system product specification	13.1.10
PDR_09	Updated design calculations	13.1.12
PDR_10	Updated declaration of design performance	13.1.13
PDR_11	Updated register of non-metallic components	13.1.14
PDR_12	Updated Weight declaration	13.1.17
PDR_13	Prototype physical configuration specification	13.1.19
PDR_14	Production physical configuration specification	13.1.19
PDR_15	Updated human factors report	13.1.21
PDR_16	Updated RVAR Compliance Matrix	13.1.22
PDR_17	Updated RAM Report	13.1.23
PDR_18	Final Prototype Test Specification	13.1.25
PDR_19	Final prototype production plan	13.1.27
PDR_20	Prototype installation instructions	13.1.28
PDR_21	Prototype CRS	13.1.30
PDR_22	Prototype CTC	13.1.31
PDR_23	Updated Maintenance documentation	13.3
PDR_24	Maintainability demonstration report	13.1.32

12.7 Post-Prototype Review (PPR)

12.7.1 The entry criteria for the PPR review is a completed PDR for which all actions have been closed to the satisfaction of the 'purchaser', completion of prototype testing and completion of the PPR Design Review Submission.

12.7.2 The PPR shall be conducted to evaluate the results of prototype testing. The 'designer's' submission shall provide sufficient information to give recommendations to be carried into Production Readiness design.

12.7.3 The PPR Design Review Submission shall include the following products.

ID	Submission	Defined in paragraph
PPR_01	Updated Risk Register	13.1.3
PPR_02	Updated Agreed Interface Definition Documents	13.1.5
PPR_03	Updated quality plan	13.1.7
PPR_04	Updated manufacturability and obsolescence management plan	13.1.8
PPR_05	Pre-Production PS	13.1.9
PPR_06	Pre-production replacement floor covering system product specification	13.1.10
PPR_07	Updated design calculations	13.1.12
PPR_08	Updated declaration of design performance	13.1.13
PPR_09	Updated register of non-metallic components	13.1.14
PPR_10	Updated Weight declaration	13.1.17
PPR_11	Prototype physical configuration audit	13.1.19
PPR_12	Updated production physical configuration specification	13.1.19
PPR_13	Updated human factors report	13.1.21
PPR_14	Updated RVAR Compliance Matrix	13.1.22
PPR_15	Updated RAM Report	13.1.23
PPR_16	Prototype Test Reports	13.1.26

PPR_17	Updated production installation instructions	13.1.28
PPR_18	Updated Maintenance documentation	13.3
PPR_19	Updated maintainability demonstration report	13.1.32

12.8 Production Readiness Review (PRR)

12.8.1 The entry criteria for the PRR review is a completed PPR for which all actions have been closed to the satisfaction of the 'purchaser' and completion of the PRR Design Review Submission.

12.8.2 The PRR shall be conducted to evaluate the results of all outstanding tests and remaining design documentation. Close out of all agreed actions of the PRR shall provide the platform for project progression to the production stage.

12.8.3 The PRR Design Review Submission shall include the following products.

ID	Submission	Defined in paragraph
PPR_01	Final Risk Register	13.1.3
PPR_02	Final Agreed Interface Definition Documents	13.1.5
PPR_03	Final Quality plan	13.1.7
PPR_04	Completed manufacturability and obsolescence management plan	13.1.8
PPR_05	FINAL PS (As-Built)	13.1.9
PPR_06	FINAL replacement floor covering system product specification	13.1.10
PPR_07	Statement of design changes	13.1.11
PPR_08	Final Design Calculations	13.1.12
PPR_09	Final declaration of design performance	13.1.13
PPR_10	Final register of non-metallic components	13.1.14
PPR_11	Final Weight declaration	13.1.17
PPR_12	Final production physical configuration specification	13.1.19

PRR_13	Final human factors report	13.1.21
PRR_14	Final RVAR Compliance Matrix	13.1.22
PRR_15	Final RAM Report	13.1.23
PRR_16	Final production installation instructions	13.1.28
PRR_17	Final training materials	13.1.29
PRR_18	Fleet fit CRS	13.1.30
PRR_19	Fleet fit CTC	13.1.31
PRR_20	Final Maintenance documentation	13.3
PRR_21	Final Maintainability Demonstration Report	13.1.32

13. DOCUMENTATION

13.1.1 Engineering Plan

The Engineering Plan shall include a work breakdown structure, incorporating all the engineering activities required to deliver the scope of work. It shall include a list of plans, specifications, schedules to be prepared and reviews to be undertaken.

13.1.2 Requirements Management Plan

The requirements management plan shall state how the 'designer' intends to manage compliance with the requirements in this TRS. The Requirements Management Plan may form a part of the Engineering Plan. It shall include but not limited to the following:

- Description of how the 'designer' intends to manage the technical requirements, including identification and recording
- The list of technical requirements
- The 'designer's' method for correlating work activities and requirements
- The 'designer's' method for identifying requirements not met by any work activity

13.1.3 Risk Register

The risk register shall list all project risks, complete with analysis of how the risk will be mitigated. It shall be kept up to date throughout the project.

13.1.4 Interface Control Plan

The interface control plan shall describe the strategy for managing the interfaces within the project and external to the project. The Interface Control Plan may form a part of the Engineering Plan. It shall:

- List the physical and functional interfaces between the 'modifications' and other train systems, items of equipment, facilities and personnel, including

those with the 'supplied equipment, and internal LU projects. It shall include all physical interfaces, all electrical interfaces and all direct system interfaces.

- Describe how the interfaces identified will be managed and controlled
- Define how interface requirements will be identified
- Define how interface risks will be resolved, controlled or mitigated

13.1.5 **Interface Definition Document (IDD)**

An interface definition document (IDD) will be produced by the 'purchaser' for all interfaces identified in the Interface Control Plan. The 'designer' shall submit such supporting evidence as requested by the 'purchaser' to ensure that the IDD's can be completed as required.

IDD's will record the details of the interface and act as an agreement between the owners of each side of the interface and the 'purchaser'. Changes shall only be made by mutual agreement of all owners.

Note: These will be key in the management of the interface between the Saloon Design project and the supplied equipment suppliers (including space envelopes, EMC requirements etc.).

13.1.6 **Engineering Safety Management Plan & Reports**

The engineering safety management plan shall list the assessments and reports that will be produced in order to meet the safety requirements in Section 13.2, Safety assessment. This shall also include a fire safety management plan. The Engineering Safety Management Plan may form a part of the Engineering Plan.

The engineering safety management reports shall summarise the emerging safety detail to reflect the progress of the developing design and include the outcome of the safety assessment and all identified studies.

13.1.7 **Quality Plan**

The quality plan shall demonstrate the recognition of quality requirements of the project, with a structured management system and methods for satisfying these requirements. The Quality Plan may form a part of the Engineering Plan. It shall contain as a minimum:

- The names of the key personnel assigned to the project with details of authority levels and responsibilities
- An organisation chart showing the relationship between the various functions of the 'designer's' employees on the project
- A method statement providing a breakdown of the scope of work into each and every activity and details of the quality control procedures, criteria and certification to be undertaken for each activity
- Details of the records of quality achievement which are to be retained and forwarded to the 'purchaser' during the agreement
- Details of all facilities used for design
- Details of specific design and quality controls

13.1.8 **Manufacturability plan**

The manufacturability plan shall demonstrate how manufacturability has been considered in the design, including evidence that the proposed designs are suitable for large scale production. It may form a part of the Engineering Plan.

13.1.9 **Product Specification**

The Product Specification, or PS, shall detail the complete design definition and specification of the 'modified trains' for manufacturing and verification purposes. It shall conform to BS 8888, LU RSE-S001 and S1180.

13.1.10 Replacement floor covering product specification

A specification detailing the product requirements of all components making up the replacement 'floor covering system'. The requirements shall be sufficiently detailed such that procurement of products in accordance with the specification will result in the procurement of a 'floor covering system' suitable for installation in accordance with the replacement 'floor covering' system' design and in compliance with the requirements of this TRS.

13.1.11 Statement of design changes

A detailed list of design changes between Prototype Design Review and Production Readiness Review. It shall include both design changes that were agreed at Post-Prototype Review and any additional design changes.

13.1.12 Design Calculations

The calculations shall include, where applicable, any structural and dynamic calculations to demonstrate compliance with this TRS, including analysis of failure conditions and fitness-for-purpose of secondary safety devices.

13.1.13 Declaration of design performance

The declaration of design performance shall include sufficient explanation (and references to supporting documents where applicable) to indicate how the requirements of this TRS will be met, with individual reference to each of the applicable requirements. The document shall include a clear statement that compliance with the TRS will be achieved and a clear statement that the proposed design will be fit for purpose. It shall also clearly indicate any items that will not be compliant with the TRS, and an explanation of the basis for any concession requests. The 'designer's' concession requests shall include sufficient evidence to demonstrate that the non-compliance is appropriate and the risk mitigations that are in place.

13.1.14 Register of non-metallic components

A register of all components within the 'modifications' that contain non-metallic materials, along with material specification, and fire performance status.

13.1.15 Design Management and Assurance Plan

13.1.16 The design management and assurance plan shall detail how the design will be managed, including the required design activities, work breakdown structure, resources allocated to each activity, plans for design reviews and assurance, technical risk and design interfaces and order of design delivery. The Design Management and Assurance Plan may form a part of the Engineering Plan.

13.1.17 Weight Management Plan & Declaration

The weight management plan shall detail the processes that will be used to monitor, control and reduce where possible the increase in weight due to 'modifications'. It may form a part of the Engineering Plan.

The weight declaration shall be derived from the PS of the relevant design review. It shall include new, modified and removed components and the potential additional passenger mass. The total change in vehicle, unit and car weight shall be calculated.

13.1.18 **Configuration Management Plan**

The configuration management plan shall describe the resource, processes, procedures and disciplines which are to be applied to ensure the full traceability and delineation of all new or modified components supplied by the 'designer'. It may form a part of the Engineering Plan.

13.1.19 **Prototype Physical Configuration Audit**

An audit of the physical configuration of prototype components shall be conducted and recorded to demonstrate the components are manufactured and installed to the PS and to capture physical changes required.

13.1.20 **Human Factors Integration Plan**

The Human Factors Integration Plan is defined in S1217. The purpose of the plan is to document the human factors activities that will be conducted throughout the design to ensure compliance with the requirements. It may form a part of the Engineering Plan.

13.1.21 **Human factors report**

The human factors report shall summarise the human factors detail of the developing design, as required by the Human Factors Integration Plan. This shall include the human factors task analysis which assesses the effects that the modifications will have on future operational and maintenance tasks.

13.1.22 **RVAR Compliance Plan & Matrix**

The RVAR compliance plan shall detail how compliance with RVAR of 'modified trains' will be ensured throughout the project. It may form a part of the Engineering Plan.

The RVAR compliance matrix will demonstrate how each RVAR requirement will be satisfied by the proposed 'modifications' at that design review.

13.1.23 **RAM strategy plan and report**

The RAM strategy plan shall define how the RAM requirements of this TRS will be met by 'modifications' and the activities required to demonstrate this.

The RAM report shall summarise the results of the activities described in the RAM strategy plan to reflect the progress of the developing design.

13.1.24 **Test Plan**

The test plan shall describe any tests that may be required to demonstrate compliance of 'modifications', including bench tests, prototype tests, type tests and routine tests during the design and prototyping. No testing is required by the 'designer' of the 'supplied equipment'.

13.1.25 **Prototype Test Specifications**

The prototype test specification shall be developed for the prototype train to facilitate the demonstration of performance of 'modifications', if required.

Any tests required shall be undertaken on a static vehicle at the 'Acton TMU facility'.

13.1.26 Prototype Test Report

The prototype test report shall detail any tests conducted on the prototype, including the nature of the tests, the pass/fail criteria, the result of the test and whether the test was passed.

13.1.27 Prototype Production Plan

The prototype production plan shall detail the plans for the manufacture of all prototype 'modifications' and any special tools, jigs and fixtures, delivery, prototype set up, production requirements, installation, testing and commissioning.

13.1.28 Installation instructions (Prototype & Production)

The installation instructions shall provide complete detail to allow the 'purchaser' to install the 'modifications'.

13.1.29 Training matrix & materials

The training matrix shall identify the training materials required to support the installation and maintenance of all 'modifications'. It shall identify where there are skills, knowledge and attribute differences between new roles and existing roles as a result of the project to list the training needs.

The training material shall detail the requirements of training to support the installation and maintenance of 'modifications'.

13.1.30 Change to Rolling Stock (CRS) (Prototype and Production)

The CRSs are LU internal submissions which will be produced by the 'purchaser'. The 'designer' shall submit such supporting evidence as requested by the 'purchaser' to ensure that the CRSs will be completed before installation commences.

13.1.31 Certification of Technical Conformance (CTC) (Prototype and Production)

The CTCs are LU internal submissions which will be produced by the 'purchaser'. The 'designer' shall submit such supporting evidence as requested by the 'purchaser' to ensure that the CTCs will be completed before installation commences.

13.1.32 Maintainability Demonstration Plan and Report

The Maintainability Demonstration Plan shall detail how maintainability shall be demonstrated i.e. physical demonstration of all maintenance activities.

The maintainability demonstration report shall detail the results of the maintainability review, highlighting any issues with the proposed maintenance process, the steps taken to identify the causes, and mitigate or rectify the same, such that the relevant causes of the TRS are complied with to the satisfaction of the 'purchaser'.

13.2 Safety assessment

13.2.1 All safety requirements apply to the 'modifications' only; 'supplied equipment' is out of scope.

13.2.2 A safety assessment shall be conducted utilising a structured systems approach to assess all areas of the design and maintenance of the 'modifications' to identify, quantify and reduce the risks to be ALARP.

- 13.2.3 The safety assessment shall assess the health and safety risks and environmental impacts of all 'modifications', activities or projects at the design, implementation, operational and decommissioning stages.
- 13.2.4 The 'designer' shall ensure that unsafe conditions and failure modes are identified and, as far as practicable, are designed out of the 'modifications'. Any remaining unsafe conditions or failure modes identified by the analyses shall be assessed for the risks associated with them; these risks shall be reduced and/or mitigated by one of the following (in descending order of preference) to the satisfaction of the 'purchaser' :
- Improved design to eliminate the failure mode.
 - Increased reliability of the modified equipment.
 - Enhanced documented maintenance regimes.
 - Documented regular testing regimes.
- 13.2.5 The safety assessments shall include the following studies, as appropriate:
- (a) Hazard Identification;
 - (b) Hazard Analysis;
 - (c) Risk Assessments and Risk Reduction Assessments;
 - (d) Failures Modes and Effects Criticality Analysis (FMECA) and Fault Tree Analysis (FTA) to enable the updating of the 'purchasers' Quantitative Risk Assessment (QRA).
 - (e) Secondary impact assessment in accordance with section 6.1.6 of GM/RT2100.
- 13.2.6 Risks associated with all aspects of the rolling stock shall be reviewed. The following aspects are amongst those that may be considered:
- movement
 - access
 - containment
 - operating in degraded mode including in-service failure
 - structural failure of rolling stock or components
 - interfaces
 - precursors to specific potential risks
 - precursors to LU Top Event Risks
- 13.2.7 The hazards associated with the following LU Top Event Risks shall be explicitly addressed:
- arcing
 - collision between trains
 - collisions, other than between trains
 - derailment
 - explosion
 - passenger train interface
 - power failure
 - train fire
 - ventilation
- 13.2.8 Minimum life requirements for all components of the 'modifications' that affect safety shall:

- (a) be documented
- (b) be justified
- (c) take into account:
 - (i) the criticality of the component
 - (ii) the associated maintenance regime

13.2.9 Controls shall be applied to mitigate the following specific risk events:

- passenger door incident
- passenger accident
- structural failure of rolling stock component or of car structural member
- stalled train
- loss of emergency lighting/ventilation, external lights or train whistle
- communications failure
- brake failure

13.2.10 The following systems and components shall also be considered as part of the safety assessment:

- those involved in mitigating the risk of platform train interface incidents
- those involved in mitigating the risk of derailment
- those involved in mitigating the risk of collision
- those involved in mitigating the risk of fire
- those involved in mitigating the risk of arcing
- those involved in mitigating the risk of ventilation failure
- software in safety systems
- communication systems
- auxiliary systems
- lighting systems
- relays
- any potential disabling failure
- any other relevant system or component, identified as traceable, and treated accordingly in the maintenance regime

13.2.11 The risks associated with the use and misuse of safety isolation, bypass or over-ride features shall be identified, with the participation of the 'purchaser', and action taken to ensure they are ALARP.

13.2.12 Safety risks related to maintenance activities shall be identified and managed to be ALARP, including but not limited to, risk of burns from equipment with a surface temperature greater than 50 degrees Celsius.

13.2.13 The proceedings, conclusions and proposals arising from safety reviews shall be formally documented including a statement on the assumptions made and the source.

13.2.14 The 'designer' shall identify items of equipment which may present hazards, to identify those hazards and to fit warning signs in accordance with the requirements of this TRS.

13.2.15 Equipment supplied as part of or for use with the 'modifications' shall be designed, constructed and installed in full accordance with the current UK Safety legislation.

13.2.16 Safety related functions for the 'modifications' shall be defined in accordance with BS EN 50126-1 (sub clauses 4.3, 4.6 and 4.7).

13.2.17 The components of the 'modifications' shall be categorised into three groups of safety criticality using an agreed method of analysis:

- Low risk – where failure of the component to perform as designed has no effect on safety;
- Medium risk – where the consequences of failure are moderate – i.e. where the likelihood of failure is low and impact on the railway of failure is not significant;
- Critical risk – where failure would or could have a significant impact on the railway

13.3 Maintenance documentation

13.3.1 The draft maintenance documents shall detail the maintenance and replacement procedures to ensure the 'modified trains' comply with the TRS for its design life. 'Maintenance documentation' includes the following documents.

13.3.2 The 'designer' shall facilitate updating of updating the Train Maintenance Regime (TMR).

13.3.3 The 'designer' shall provide detail to facilitate updating of the illustrated parts list for 72TS in accordance with LU-RSE-S001 to reflect the 'modified trains'.

13.3.4 The 'designer' shall provide detail to facilitate updating of the maintenance manual for 92TS in accordance with LU-RSE-S001 to reflect the 'modified trains'.

13.3.5 The 'designer' shall provide work instructions that comply with LU-RSE-S001 for all routine cleaning, maintenance, testing and inspection tasks required to maintain the serviceable condition and safe operation of the 'modifications' throughout the design life.

13.3.6 The 'designer' shall provide work instructions that comply with LU-RSE-S001 for all expected 'casualty maintenance' and inspection tasks anticipated within the design life of the 'modifications'.

13.3.7 The 'designer' shall provide raw data and images to allow the 'purchaser' to:
(a) issue 'train operator' guidance information relating to the 'modifications'
(b) update existing Defect Guides for the rolling stock type

13.3.8 The 'designer' shall provide a storage schedule to the 'purchaser', which shall comply with LU-RSE-S001.

13.3.9 The 'designer' shall provide 'Train the Trainer' training and associated training materials to the 'purchaser' for installation and maintenance of the 'modifications'.

13.3.10 The supplier shall give maintenance demonstrations for the purpose of LU health and safety risk assessment and human factors analyses.

14. REFERENCED DOCUMENTS

14.1.1 The following documents are referenced in this TRS.

Reference	Issuer	Title/Description	Version
BS 3692	BSI	ISO metric precision hexagon bolts, screws and nuts. Specification	2014
BS 6416	BSI	ISO 1703-1983 Nomenclature for assembly tools for screws and nuts	1983
BS 6853	BSI	Code of practice for fire precautions in the design and construction of passenger carrying trains	1999
BS 7608	BSI	BS 7608:2014+A1:2015. Guide to fatigue design and assessment of steel products	2014
BS 7776	BSI	Glossary of torque terminology for threaded fasteners	1995
BS 7976-2	BSI	BS 7976-2:2002+A1:2013. Pendulum testers. Method of operation	2002
BS 8118-1	BSI	Structural use of aluminium. Code of practice for design	1991
BS 8300	BSI	BS 8300:2009+A1:2010. Design of buildings and their approaches to meet the needs of disabled people. Code of practice	2009
BS 8888	BSI	Technical product documentation and specification	2013
BS EN 1176-1	BSI	Playground equipment and surfacing. General safety requirements and test methods	2008
BS EN 12663-1	BSI	BS EN 12663-1:2010+A1:2014. Railway applications. Structural requirements of railway vehicle bodies. Locomotives and passenger rolling stock (and alternative method for freight wagons)	2010
BS EN 1372	BSI	Adhesives. Test method for adhesives for floor and wall coverings. Peel test	2015
BS EN 15085	BSI	Railway applications. Welding of railway vehicles and components. (Parts 1 to 5).	2007

BS EN 1903	BSI	Adhesives. Test method for adhesives for plastic or rubber floor coverings or wall coverings. Determination of dimensional changes after accelerated ageing	2015
BS EN 438-2	BSI	High-pressure decorative laminates (HPL). Sheets based on thermosetting resins (usually called laminates). Determination of properties	2016
BS EN 50125-1	BSI	Railway applications. Environmental conditions for equipment. Rolling stock and on-board equipment	2014
BS EN 50126-1	BSI	Railway applications. The specification and demonstration of reliability, availability, maintainability and safety (RAMS). Basic requirements and generic process	1999
BS EN 50155	BSI	Railway applications. Electronic equipment used on rolling stock	2007
BS EN 50343	BSI	Railway applications. Rolling stock. Rules for installation of cabling	2014
BS EN 60297-3	BSI	Parts 100-109? Mechanical structures for electrical and electronic equipment. Dimensions of mechanical structures of the 482,6 mm (19 in) series	2016
BS EN 60529	BSI	BS EN 60529:1992+A2:2013. Degrees of protection provided by enclosures (IP code)	1992
BS EN 60603-2	BSI	Connectors for frequencies below 3 MHz for use with printed boards. Detail specification for two-part connectors with assessed quality, for printed boards, for basic grid of 2,54 mm (0,1 in) with common mounting features	1998
BS EN 61373	BSI	Railway applications. Rolling stock equipment. Shock and vibration tests	2010
BS EN 62676-4	BSI	Video surveillance systems for use in security applications. Application guidelines	2015
BS EN 660-2	BSI	BS EN 660-2:1999+A1:2003. Resilient floor coverings. Determination of wear resistance. Frick-Taber test	1999

BS EN 663	BSI	Resilient floor coverings. Determination of conventional pattern depths	1995
BS EN ISO 105-B02	BSI	Textiles. Tests for colour fastness. Colour fastness to artificial light: Xenon arc fading lamp test	2014
BS EN ISO 14588	BSI	Blind rivets. Terminology and definitions	2001
BS EN ISO 1891-2	BSI	Fasteners. Terminology. Vocabulary and definitions for coatings	2014
BS EN ISO 23997	BSI	Resilient floor coverings. Determination of mass per unit area	2012
BS EN ISO 23999	BSI	Resilient floor coverings. Determination of dimensional stability and curling after exposure to heat	2012
BS EN ISO 24341	BSI	Resilient and textile floor coverings. Determination of length, width and straightness of sheet	2012
BS EN ISO 24343-1	BSI	Resilient and laminate floor coverings. Determination of indentation and residual indentation. Residual indentation	2012
BS EN ISO 24344	BSI	Resilient floor coverings. Determination of flexibility and deflection	2012
BS EN ISO 24346	BSI	Resilient floor coverings. Determination of overall thickness	2012
BS EN ISO 3095	BSI	Acoustics. Railway applications. Measurement of noise emitted by railbound vehicles	2013
BS EN ISO 3381	BSI	Railway applications. Acoustics. Measurement of noise inside railbound vehicles	2011
BS ISO 10577	BSI	Resilient floor coverings. Specification for rubber sheet floor coverings without back	2012
BS ISO 1891	BSI	Fasteners. Terminology	2009
BS ISO 226	BSI	Acoustics. Normal equal-loudness-level contours	2003

BS ISO 37	BSI	Rubber, vulcanized or thermoplastic. Determination of tensile stress-strain properties	2011
BS ISO 4649	BSI	Rubber, vulcanized or thermoplastic. Determination of abrasion resistance using a rotating cylindrical drum device	2010
BS ISO 5391	BSI	Pneumatic tools and machines. Vocabulary	2003
BS ISO 7619-1	BSI	Rubber, vulcanized or thermoplastic. Determination of indentation hardness. Durometer method (Shore hardness)	2010
LU drawing 100524	LU drawing	J-door key	A
LU drawing 52544	LU drawing	J-door key lock	H
LU drawing 200346	LU drawing	Special baseplate for damaged grabpole repair	A
Aesthetic Concept	LU project	Purchaser' documents (72TS and 92TS) describing the desirable aesthetic concept of 'modified trains'. Draft versions are supplied, to be updated for contract award.	Draft 0.1
Environmental Context Document	LU project	Purchaser' documents (72TS and 92TS) describing the environmental context for each line.	Issue 1
LU-RSE-S001	LU project	Rolling Stock Engineering Product Specification requirements	0.10
LU-RSE-T001	LU project	Graffiti resistance type test	0.4
LU-RSE-T002	LU project	Liquid resistance type test	0.3
PVEC3130-TR- 02-010	LU project	72TS RVAR compliance, Technical Feasibility Report, Zoe Dobell	Issue 1
PVEC3131-TR- 02-010	LU project	92TS RVAR compliance, Technical Feasibility Report, Zoe Dobell	Issue 1
PVEC3126-TR- 02-001	LU project	Central line Floor Corrosion Repairs Project Feasibility Report, Scott Butcher	Issue 1

APE-RS-AM067-TR-3-A1	LU - APE	92TS Carbody Fatigue Crack Assessment – Overview Report	A1
1-382	LU standard	Category 1. Train decor design	A6
G085	LU standard	Guidance Document. Code of practice - Fire Safety of Materials and Fire Safety of Specific Items and Materials Used in the Underground	A5
G222	LU standard	Guidance Document. EMC best practice.	A2
S1156	LU standard	Category 1. Gauging and Clearances	A8
S1180	LU standard	Category 1. Standard for Rolling Stock	A6
S1193	LU standard	Category 1. Electromagnetic Compatibility (EMC) with LU Signalling System Assets	A3
S1217	LU standard	Category 1. Integration of Human Factors into System Development	A2
S1222	LU standard	Category 1. Electromagnetic Compatibility (EMC)	A2
S1538	LU standard	Category 1. Assurance	A11
GM/RT2100	Safety & Standards Directorate	Requirements for Rail Vehicle Structures	Issue 5
RTUKR-T36948-002	Other	London Underground Task 50, Equipment Relocation Feasibility Study for 72TS, Dennis Isam	Issue 1
RTUKR-T36948-003	Other	London Underground Task 50, Equipment Relocation Feasibility Study for 92TS, Dennis Isam	Issue 1

15. APPENDIX A – ADDITIONAL INFORMATION

15.1 72TS

15.1.1 72TS is a 7-car train formation made up of two units:

- a 3-car unit
- a 4-car unit

15.1.2 The trains are predominantly of the Mk2 variant, but also include four trains of the earlier Mk1 variant (the units are capable of inter-running). There are small differences between the two, which shall be accounted for in all designs.

15.1.3 3-car units are formed: D-Driving Motor – Special Trailer – Uncoupling Non-Driving Motor (D-DM-SpT-UNDM).

15.1.4 4-car units are formed: A-Driving Motor – A-Trailer – D Trailer – Uncoupling Diving Motor (A-DM – A-T – D-T – D-DM).

Note: the D-DM is always marshalled in the middle of a train and some documents refer to them as 'Middle Motor' cars. One unit (Unit 3299) has a UNDM car (i.e. without a cab) in this position).

15.1.5 The nominated wheelchair car on 72TS is the Special Trailer.

15.1.6 The nature of the Bakerloo line means that 72TS trains cannot turn around. 3-car units are always at the north end of the train and 4-car units at the south end.

15.2 92TS (Central)

15.2.1 The 92TS (Central) fleet is made up of 85 trains.

15.2.2 92TS (Central) is an 8-car train formation made up of four 2-car units, from the available:

- 2-car units called 'AB units'
- 2-car units called 'BC units'

15.2.3 Each 2-car unit is composed of a B car and either an A or C car. An A car has a cab, while a C car contains much of the same equipment but without the cab.

15.2.4 A typical train will feature an AB unit at either end, with AB or BC units in the middle. The end AB units must be orientated with the A cars facing outwards, while the two centre units can be orientated either way.

15.2.5 A number of the C cars are fitted with equipment to dispense de-icing fluid through the 'shoegear', sometimes designated C(D) cars. BC(D) units are considered a sub-set of BC units.

15.2.6 The composition of the 92TS (Central) fleet is described below:

Unit	Description	Quantity
AB	2-car unit with a driving cab.	175

BC	2-car unit without a driving cab	133
BC(D)	2-car de-icing unit without a driving cab	32

15.2.7 The nominated wheelchair car on 92TS (Central) is the B car of AB units, i.e. 175 cars

15.2.8 The nature of the line and the train formation means that units can turn around and can be coupled in any combination. Changing the formation of units is known as 'reforming'.

15.3 92TS (W&C)

15.3.1 The 92TS (W&C) fleet is made up of five trains.

15.3.2 Each 92TS (W&C) train is a 4-car train formation made up of two EF 2-car units.

15.3.3 EF units are the W&C-equivalent of the AB units on 92TS (Central).

15.3.4 The nature of the line means that the trains do not turn around.

15.3.5 The nominated wheelchair car on 92TS (W&C) is the F car of EF units at the Bank end.

15.4 Operating environment

15.4.1 The environment in which the 72TS, 92TS (Central) and 92TS (W&C) operates is described in detail in the Environmental Context Documents.

15.5 User groups

User Group	Frequency of Use	Functions	Levels
'Train operators'	Continuous	Operational Functionality	Trained in operating from the cab and fault finding in the saloon and equipment underseats.
Fleet 'maintenance staff'	Scheduled	Monitoring Maintaining	Trained for 'routine maintenance' tasks and fault finding.
Engineering staff working in fleet	Infrequent	Monitoring	Trained to support maintenance and provide guidance.
Specialist / discipline engineering staff	Infrequent	Monitoring	Have specific asset knowledge to provide advice / guidance to Engineering staff working in fleet, and train 'maintenance staff'
Fleet training staff	Scheduled	Monitoring	Trained and responsible for cascading appropriate training to fleet 'maintenance staff'.

15.6 Rail Vehicle Accessibility (Non-Interoperable Railways) Regulations (RVAR)

- 15.6.1 Rail Vehicle Accessibility (Non-Interoperable Railways) Regulations (referred to in this TRS as RVAR) were brought into force in 1998 and then updated in 2010 to address accessibility on rolling stock. For fleets that were manufactured before the regulations were brought into force, it is required that any modifications done to the train are RVAR compliant and that full RVAR compliance is achieved by 1st January 2020.
- 15.6.2 A feasibility phase has been conducted to assess compliance and seek exemptions. Exemptions have been recommended and agreed in principle with the DfT, the details of which are stated below. Full RVAR compliance is expected otherwise, forming the requirements of this TRS and the 'supplied equipment'.
- 15.6.3 Exemptions have been sought on 72TS, and so the following clarifications apply:
- (a) Horizontal handrails on 'unmodified trains' with a diameter of 29mm are not required to be modified to comply with RVAR
 - (b) 'Doorway handrails' are required on only the draughtscreen side of single doorways. Additional handrails on the body end side of single doorways are not required to comply with RVAR
- 15.6.4 Exemptions have been sought on 92TS (Central), and so the following clarifications apply:
- (a) 'Doorway handrails' in 'unmodified trains' do not require modification to comply with the 'usable height' as specified in RVAR
 - (b) All saloon seats do not require modification to comply with the requirements of priority seats as specified in RVAR
 - (c) Handrails above 'passenger doorways' do not need to be modified to comply with clearance requirements as specified in RVAR. Required modifications are related to colour only.
- 15.6.5 All those exemptions as for 92TS (Central) will also apply to 92TS (W&C) but the following clarifications also apply:
- (a) Provision of a Passenger Information System is not required to comply with RVAR
 - (b) Provision of wheelchair spaces (and associated PEA and signage) is not required

15.7 Aesthetic Concept

- 15.7.1 Some 'modifications' have been artistically modelled to demonstrate acceptable aesthetics within each train interior design. They also include specified colour schemes.
- 15.7.2 These have been collated into guidance documents called Aesthetic Concepts. They are not intended to specify the solution, locations or space envelopes of 'modifications' or 'supplied equipment', rather give a feel for the desired aesthetics.

15.8 Grab pole base and seat bases - 92TS (Central) & 92TS (W&C)

- 15.8.1 For the two vertical grab poles attached to the floor in the centre of the 6-seat bay areas in each car, a new design of grab pole base with additional fixings and a significantly larger footprint has been implemented on a small number of 92TS (Central) units. LU drawing

200346 details the new design. These bases have been installed where damage due to vandalism or corrosion has prevented the existing base design from being reused. This new design shall be reviewed, modified if necessary to mitigate any issues associated with corrosion in the area.

15.9 Sill plate redesign - 92TS (Central) & 92TS (W&C)

- 15.9.1 The side door sill plates (including the cab side door) require removal to address corrosion damage underneath. The current design of the sill plate features a fixing which cannot be accessed without removing the door leaves. The door leaves therefore need to be removed to enable sill plate removal.
- 15.9.2 The existing joint interface between 'floor covering' and sill plate is a known weak point where liquids can ingress to the underlying aluminium structure.
- 15.9.3 The RVAR regulations require a 'threshold strip' across each saloon doorway. The existing sill plate design does not feature a 'threshold strip'.

15.10 Door pillar inspection panel - 92TS (Central) & 92TS (W&C)

- 15.10.1 Structural assessments have identified the lower door corner areas of the 92TS carbody structure as having a low fatigue life and therefore at risk of fatigue cracking. Ongoing inspections and crack growth monitoring will be required to mitigate the risks associated with these cracks. Document APE-RS-AM067-TR-3-A1 produced by Asset Performance Engineering provides an overview of the fatigue life issue and identifies the location of crack initiation on the lower door pillar.

16. APPENDIX B – ADDITIONAL REQUIREMENTS

16.1 Structural analysis

16.1.1 The following requirements are applicable to structural analysis completed by the 'designer'.

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

The structural integrity of 'modified cars' shall meet the requirements of category P-III in BS EN 12663. The uncertainty factor S1 shall be 1.15 for proof load cases.

409

For assessment of the structural integrity of the 'modified car', the compressive force at buffer level (BS EN 12663 Table 2) shall be 1000kN and the tensile force in coupler area (BS EN 12663 Table 5 and Table 12) shall be 200kN. This load shall also be applied in compression as an additional load case.

2100

A load case shall simulate the car body twist condition corresponding to the derailment of one bogie with the other remaining on flat track:

2101

- (a) The derailed bogie shall have its secondary suspension acting in its most disadvantageous condition
- (b) There shall be a vertical difference of 130mm in wheel height between the wheels on one side of the derailed bogie (at rest on sleepers) and the opposite wheels (lodged on a rail)
- (c) The car body shall be in 'Crush Laden' condition plus a 15% dynamic increment

The car body shall support the total weight of a motored bogie when that load is reacted at the car body trailing end secondary suspension point and the leading end cab anti-over-ride position.

2102

As far as is practicable, the 'modified train' body structures shall not collapse in an uncontrolled manner as a result of high longitudinal loads encountered during rough couples and collisions as defined in section 3.10.11 of S1180.

1618

Fatigue strength shall be demonstrated using a cumulative damage approach and assessed using:

2103

- (a) BS 7608 with a 2.3% probability of failure for steel structures
- (b) BS 8118-1 for aluminium structures
- (c) academically peer-reviewed, data for steel castings

The damages shall be calculated for each of the following fatigue load cases and the total summed damage for all load cases shall not exceed unity: ☑☑☑ 2104

- (a) 100 million cycles of stress fluctuating at $\pm 10\%$ of the vertical stresses for the loading condition of all seated passengers, with no standing passengers
- (b) 10 million cycles of stress fluctuating at $\pm 10\%$ of the vertical stress for the 'Crush Laden' condition
- (c) 0.1 million cycles of stress fluctuations caused by a lateral acceleration of $\pm 0.1g$ for the loading condition of all seated passengers, with no standing passengers
- (d) 2 million cycles of stress fluctuations caused by passenger loading/unloading comprising the following load ranges:

Passenger load range	Cycles x 10 ⁶
33% Crush Laden	1.00
50% Crush Laden	0.50
66% Crush Laden	0.30
83% Crush Laden	0.12
100% Crush Laden	0.08

(e) stress cycles induced from track twist (twist range is the amount over a 10m base, by which one point of the four is out of plane with the other three) with the following 10m track twist spectrum:

Twist Range (mm)	Cycles/km
10	600.0
15	22.0
25	8.0
35	3.0
50	2.0
70	1.5
100	0.2

The design mass definitions detailed in section 3.10.2. of S1180 shall be applied. ☑☑☑ 2105

The natural modes of vibration of the 'modified car' body, in all operating conditions, shall be separated sufficiently, or otherwise decoupled, from the suspension frequencies, so as to avoid the occurrence of undesirable resonances. ☑☑☑ 1617

16.2 Line Replaceable Units (LRUs)

16.2.1 The following requirements are applicable to 'LRUs' designed for the 'modified train'.

Requirement Text

727S
927S (Central)
927S (W&C)
Req ID

'Modifications' shall permit damaged items of equipment (e.g. due to stripped or worn screw threads) to be reclaimed. ☑☑☑ 454

'Modifications' considered 'LRUs' shall use standard engineering fixings, seals and connections for their installation and removal.	☑☑☑ 456
The removal of one 'LRU' shall not require any other 'LRUs' or components, except the immediately local fixings, to be disturbed.	☑☑☑ 459
Electrical connections to 'LRUs' shall be via multi-pole connectors.	☑☑☑ 460
Connections to 'LRUs' for diagnostics or overhaul, which are not usually connected in service, shall be protected by a cover to prevent misuse and accidental damage.	☑☑☑ 461
'LRUs' shall be capable of being placed on a flat surface without causing mechanical damage to any component.	☑☑☑ 462
'LRUs' shall be arranged so that they can be easily manoeuvred in and out of position, taking full account of the location of the equipment and in accordance with the human factors requirements of this TRS.	☑☑☑ 463
'LRUs' shall be provided with a legible, permanent label indicating the key parameters of the equipment (e.g. description, type, where used, setting, version, modification status).	☑☑☑ 464
'LRUs' shall incorporate mechanical means of polarisation, or coding, to prevent incorrect insertion.	☑☑☑ 465
Identification of a failed 'LRU' shall not require removal or replacement of any component.	☑☑☑ 466

16.3 Floor Covering

16.3.1 Liquid ingress

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

Interior 'floor surfaces', including joints, shall provide IPX7 liquid ingress protection to the underlying floor structure in accordance with BS EN 60529.	☒☑☑ 855
Three specimens of the 'floor covering system' shall be demonstrated to be water tight when tested in accordance with Annex A of BS EN 13553:2015, both before and after being tested in accordance with BS EN 425:2002.	☒☑☑ 2185
Note: The specimen design, including joints, shall comply with BS EN 425:2002.	

Three specimens of the 'floor covering system' incorporating at least one example of each 'floor surface' component, such as sill plates and coving, shall be demonstrated to be water tight when tested in accordance with Annex A of BS EN 13553:2015. ☒☑☑ 2186

Note: The specimen design shall be based on Figure A.1 in BS EN 13553:2015 and agreed with the 'LU Engineer' prior to testing.

16.3.2 Non-metallic floor covering

Requirement Text

72TS
92TS (Central)
92TS (W&C)
Req ID

The 'floor covering' shall be fully bonded to the floor structure and shall maintain a smooth surface. The strength of the bond shall be adequate to prevent de-bonding when the floor is subject to foot traffic, chemical attack, environmental variations and impact. ☒☑☑ 1558

The adhesion of the replacement 'floor covering system' to its substrate under peel forces shall be at least 1.2N/mm when tested in accordance with BS EN 1372 and the following conditions: ☒☑☑ 1137

(a) All three conditioning sequences shall be used.
(b) The specimen substrate shall be of identical specification to that used in modified trains.

'Floor surfaces' shall have a colour fastness under xenon arc light of at least 6 on the blue wool scale or 3 on the grey scale when tested in accordance with BS EN ISO 105-B02 Method 3. The size of the test specimen shall be maximised and a control test specimen shall be stored in the dark for assessing the colour change. ☒☑☑ 864

The resistance to UV light of external, non-metallic 'floor surfaces' shall be determined in accordance with section 28 of BS EN 438-2 with the following success criteria: ☒☑☑ 100

(a) At least the colour fastness of BS EN ISO 105-B02 blue wool reference 6
(b) Change of appearance rating of 4 or 5

The length and width of the roll form of the replacement 'floor covering' shall be determined in accordance with BS EN ISO 24341 and shall not be less than the stated nominal values. ☒☑☑ 1073

The thickness of the replacement 'floor covering' shall be determined in accordance with BS EN ISO 24346 and shall be the same as the unmodified 'floor covering'. ☒☑☑ 1129

The average 'floor covering' thickness measurement shall be no greater than $\pm 0.20\text{mm}$ of the stated nominal thickness. ☒☑☑ 1130

- Any individual 'floor covering' thickness measurement shall be no greater than $\pm 0.25\text{mm}$ of the stated nominal thickness. ☒☑☑ 1131
- The mass per unit area shall be determined in accordance with BS EN ISO 23997. ☒☑☑ 1132
- The dimensional stability of the replacement 'floor covering' after exposure to heat shall be determined in accordance with BS EN ISO 23999 and shall be no greater than $\pm 0.4\%$. ☒☑☑ 1133
- The replacement 'floor surfaces' shall have no more than 0.1mm of residual indentation after the application and removal of a constant load in accordance with BS EN ISO 24343-1. ☒☑☑ 1060
- The flexibility of the replacement 'floor surfaces' shall be determined in accordance with BS EN ISO 24344 Method A and shall attain a pass when tested with a 20mm mandrel. ☒☑☑ 1134
- The indentation hardness of the replacement 'floor surfaces' shall be at least 75 Shore A when tested in accordance with BS ISO 7619-1. ☒☑☑ 1139
- The replacement 'floor covering' shall have a tensile strength greater than 8MPa and an elongation at yield greater than 50%, when measured in accordance with BS ISO 37 and the following conditions: ☒☑☑ 1136
- (a) At least five specimens shall be tested and all shall meet the minimum strength and elongation requirements.
 - (b) Each different profile in the replacement 'floor covering' shall be tested using a specimen containing the profile in its weakest orientation.
 - (c) Specimen shape shall be Type 2 dumb-bell.
 - (d) Rate of traverse of the moving grip of the tensile-testing machine shall be 500mm/min.
 - (e) Displacement measurements shall be made with an optical extensometer.
- The dimensional change of the replacement 'floor covering' after accelerated ageing shall be no more than 0.2% when tested in accordance with BS EN 1903 and the following conditions: ☒☑☑ 1138
- (a) Specimens shall not undergo elevated temperature pre-treatment.
 - (b) The specimen substrate shall be of identical specification to that used in modified trains.
- The wear resistance of the replacement 'floor surfaces' shall be determined in accordance with BS EN 660-2 with the following success criteria: ☒☑☑ 1062
- (a) Mass loss shall be no more than 3g per 2500 revolutions.
 - (b) Rate of mass loss shall be approximately constant.
 - (c) Mean maximum volume loss, calculated from the measured mass loss, shall be less than 500mm^3 per 1000 revolutions.
- Test samples shall be pre-conditioned for 1000 revolutions before testing and mass shall be determined every 500 revolutions.

The abrasion resistance of the replacement 'floor surfaces' shall be determined in accordance with BS ISO 4649 using Method A and a vertical load of $5N \pm 0.1N$. The relative volume loss shall be no greater than 250mm^3 . ☒☑☑ 1140

The ratio of pattern depth in millimetres, measured in accordance with BS EN 663 Method C, to thickness loss in millimetres, calculated in accordance with section 6 of BS ISO 10577, shall be less than 1.5 for the replacement 'floor surfaces'. ☒☑☑ 1141

The colour of the joint material shall be agreed between the 'designer' and the 'LU Engineer'. Where the joint is between 'floor covering' of identical material, the colour of the joint material is to be similar to that of the base colour of those sheets. ☒☑☑ 1562

The joint material shall have material properties that will create a strong bond to the edges of the 'floor surfaces' and have elastic properties that will prevent 'edge de-bonding' when subject to floor loading, moisture and temperature movement, vibration and chemical attack. ☒☑☑ 1563

The replacement 'floor surfaces' shall be proven to be resistant to the following under service conditions similar to those specified in the Environmental Context Document: ☒☑☑ 868

- (a) Swelling
- (b) Bubbling
- (c) Cutting
- (d) Tearing
- (e) Ingraining of dirt
- (f) Porosity
- (g) Joint separation

17. APPENDIX C – PREVIOUS WORK

17.1 General

17.1.1 Any previous work is made available but is for information only.

17.2 Floor corrosion repair and replacement floor covering system (92TS only)

17.2.1 A feasibility study considering floor corrosion on 92TS Central line cars has been completed and is summarised in report PVEC3126-TR-02-001.

17.2.2 Repair methods considered previously include:

- Removing areas of the top skin of aluminium affected by corrosion damage and welding new repair pieces in place.,
- Bonding a sheet of new aluminium over damaged areas.

There are however issues associated with the implementation and likely life of repair for both of these methods. Therefore, an alternative repair method is sought.

17.2.3 The issues associated with welding which should be mitigated by the designed repair method include:

- Long implementation timescales, including significant preparatory and recommissioning activities that include electronic equipment disconnection
- Limited maximum size of individual repair
- Bespoke repairs with minimal repeatability
- The effects of corrosion on repair quality

17.2.4 The issues associated with bonding in an overplate which should be mitigated by the designed repair method include:

- Matching the profile of the existing floor structure with large over-plates due to the mismatch in stiffness and geometry between the floor and plate
- The introduction of a step in the floor where small over-plates are used
- Integrity of bond between over-plate and floor
- The likelihood that the above will lead to rapid debonding of the floor covering at the point of repair.

17.2.5 It is widely accepted in the materials science community that debond initiation and propagation in epoxy bonds to aluminium substrates is due to the hydration of aluminium oxide on the aluminium adherent surface. Bond durability can therefore be improved by decreasing the rate of water diffusion, both through the adhesive and along the bond-line, and/or increasing the hydration resistance of the oxide. The first of these can be achieved by improving the water-resistance of the adhesive, by use of a hydration inhibitor or by application of a primer. The second can be achieved by the creation of a hydration resistant oxide by chemical etching, with Phosphoric Acid Anodising (PAA) leading to the greatest durability of the available processes. ASTM D3933 and Boeing BAC 5555 are standard methods for creating a hydration-resistant oxide layer by PAA. See the following:

- Davis, Joseph R. Aluminium and Aluminium Alloys. [ed.] Joseph R Davis. Novelty : ASM International, 1993. ISBN: 978-0-87170-496-2. pp 443-444.
- Davis, M.J., Bond, D.A. The Importance of Failure Mode Identification in Adhesive Bonded Aircraft Structures and Repairs. Adhesion Associates. [Online] 5 July 1999. [Cited: 17 September

2015.] <http://www.adhesionassociates.com/papers/46%20Importance%20of%20Failure%20Mode%20Identification%20ICCM%2012%20Paris.pdf>. p. 2

17.3 Wheelchair spaces and equipment relocation

17.3.1 Detailed feasibility studies have been conducted on the required equipment relocation to fit wheelchair spaces to 72TS and 92TS (Central):

- 72TS: RTUKR-T36948-002
- 92TS (Central): RTUKR-T36948-003

17.4 Other RVAR elements

17.4.1 The feasibility of implementing the RVAR elements was assessed and concluded with the following reports:

- 72TS: PVEC3130-TR-02-010
- 92TS (Central) and 92TS (W&C): PVEC3131-TR-02-010

17.4.2 These reports also assess elements that extend beyond the scope of Saloon Design project.

18. APPENDIX D

Design Acceptance Products Matrix

SALOON DESIGN												
CONCEPT DESIGN				DETAIL DESIGN		PROTOTYPING				PRODUCTION READINESS		
Specification Design Review		Concept Design Review		Detailed Design Review		Prototype Design Review		Post-Prototype Review		Production Readiness Review		
ID	SDR	ID	CDR	ID	DDR	ID	PDR	ID	PPR	ID	PRR	
Feasibility	SDR_00	Feasibility Investigation Report										
General documentation	SDR_01	Engineering Plan	CDR_01	Updated Engineering Plan	DDR_01	Updated Engineering Plan	PDR_01	Final Engineering Plan				
	SDR_02	Requirements Management Plan										
	SDR_03	Risk Register	CDR_02	Updated Risk Register	DDR_02	Updated Risk Register	PDR_02	Updated Risk Register	PPR_01	Updated Risk Register	PRR_01	Final Risk Register
	SDR_04	Interface Control Plan	CDR_03	Updated Interface Control Plan								
			CDR_04	Interface Definition Documents	DDR_03	Agreed Interface Definition Documents	PDR_03	Updated Agreed Interface Definition Documents	PPR_02	Updated Agreed Interface Definition Documents	PRR_02	Final Agreed Interface Definition Documents
	SDR_05	Engineering Safety Management Plan	CDR_05	Completed Engineering Safety Management Plan	DDR_04	Initial engineering safety management report	PDR_04	Engineering safety management report				
	SDR_06	Quality Plan	CDR_06	Updated Quality Plan	DDR_05	Updated quality plan	PDR_05	Updated quality plan	PPR_03	Updated quality plan	PRR_03	Final Quality plan
	SDR_07	Initial manufacturability plan	CDR_07	Updated manufacturability plan	DDR_06	Updated manufacturability plan	PDR_06	Updated manufacturability plan	PPR_04	Updated manufacturability plan	PRR_04	Completed manufacturability plan
Designs and supporting documentation	SDR_08	Product Specification (PS)	CDR_08	Concept PS	DDR_07	Detailed PS	PDR_07	Prototype PS	PPR_05	Pre-Production PS	PRR_05	FINAL PS (As-Built)
			CDR_09	Concept replacement floor covering system product specification	DDR_08	Detailed replacement floor covering system product specification	PDR_08	Prototype replacement floor covering system product specification	PPR_06	Pre-production replacement floor covering system product specification	PRR_06	FINAL replacement floor covering system product specification
											PRR_07	Statement of design changes
			CDR_10	Design calculations	DDR_09	Updated design calculations	PDR_09	Updated design calculations	PPR_07	Updated design calculations	PRR_08	Final design calculations
			CDR_11	Declaration of design performance	DDR_10	Updated declaration of design performance	PDR_10	Updated declaration of design performance	PPR_08	Updated declaration of design performance	PRR_09	Final declaration of design performance
			CDR_12	Register of non-metallic components	DDR_11	Updated register of non-metallic components	PDR_11	Updated register of non-metallic components	PPR_09	Updated register of non-metallic components	PRR_10	Final register of non-metallic components
Assurance	SDR_09	Design Management and Assurance Plan										
	SDR_10	Weight Management Plan			DDR_12	Initial Weight declaration	PDR_12	Updated Weight declaration	PPR_10	Updated Weight declaration	PRR_11	Final Weight declaration
	SDR_11	Configuration Management Plan	CDR_13	Updated Configuration Management Plan	DDR_13	Configuration management plan	PDR_13	Prototype physical configuration specification	PPR_11	Prototype physical configuration audit		
							PDR_14	Production physical configuration specification	PPR_12	Updated production physical configuration specification	PRR_12	Final production physical configuration specification
	SDR_12	HF Integration Plan	CDR_14	Initial human factors report	DDR_14	Updated human factors report	PDR_15	Updated human factors report	PPR_13	Updated human factors report	PRR_13	Final human factors report
	SDR_13	RVAR Compliance Plan	CDR_15	RVAR Compliance Matrix	DDR_15	Updated RVAR Compliance Matrix	PDR_16	Updated RVAR Compliance Matrix	PPR_14	Updated RVAR Compliance Matrix	PRR_14	Final RVAR Compliance Matrix
	SDR_14	RAM Strategy Plan	CDR_16	Completed RAM Strategy Plan	DDR_16	Initial RAM Report	PDR_17	Updated RAM Report	PPR_15	Updated RAM Report	PRR_15	Final RAM Report
Testing	SDR_15	Initial Test Plan	CDR_17	Updated Test Plan	DDR_17	Updated Test Plan						
					DDR_18	Prototype Test Specification	PDR_18	Final Prototype Test Specification	PPR_16	Prototype Test Reports		
Installation	SDR_16	Initial Prototype Production Plan	CDR_18	Updated Prototype Production Plan	DDR_19	Updated Prototype Production Plan	PDR_19	Final Prototype Production Plan				
			CDR_19	Initial installation instructions	DDR_20	Updated installation instructions	PDR_20	Prototype installation instructions	PPR_17	Updated production installation instructions	PRR_16	Final production installation instructions
			CDR_20	Training Matrix Plan	DDR_21	Initial Training Materials					PRR_17	Final training materials
							PDR_21	Prototype CRS			PRR_18	Fleet fit CRS
							PDR_22	Prototype CTC			PRR_19	Fleet fit CTC
Maintenance					DDR_22	Draft Maintenance documentation	PDR_23	Updated Maintenance documentation	PPR_18	Updated Maintenance documentation	PRR_20	Final Maintenance documentation
					DDR_23	Maintainability Demonstration Plan	PDR_24	Maintainability demonstration report	PPR_19	Updated maintainability demonstration report	PRR_21	Final Maintainability Demonstration Report

Appendix 3

Technical Requirements Specification Assumptions

TRS requirement no.	Clause Text	Condition / assumption for compliance
4.2.1	4.2.1 The scope of the feasibility investigation is to determine the optimum position within the car interior for: <ul style="list-style-type: none"> • Saloon LED lighting (new) • Saloon PIS loudspeakers (new or existing, see note below) • Saloon CCTV cameras (new) Note: The PIS TRS requires an assessment to be conducted by the PIS supplier on the saloon loudspeakers to determine whether they should be retained or replaced.	Achievement of this requirement is subject to the provision of appropriate system information by LU.
8.2 - 193	Unless otherwise agreed, the issue of any standard which applies at the date of contract award shall be the version of that standard which is applied. Note: Controlled copies of applicable and agreed LU standards are available via the LU standards portal https://www.ihs.com/permission/lulstandards/index.html	NB Due to the design standards for the vehicle in the project differing in some cases from the current standards, we would expect LU to accommodate a level of flexibility in the approach used, noting this will be agreed on a case by case basis.
8.2 - 195	Any supporting documentation or information referred to in this TRS is provided for the 'designer's information and guidance only. The 'purchaser' shall not accept any liability including delays or costs resulting from any information this may contain. Note: A limited suite of drawings exists for London Underground rolling stock. The drawings are uncontrolled copies, supplied by the London	NB We require LU to provide us with access to 72TS and 92TS units in stripped down state in order to be able to examine all relevant structural elements of the trains
8.2 - 198	The 'designer' shall survey the rolling stock to determine, as far as possible, all information required to deliver the Saloon Design project.	To support this requirement, we will require LU to provide access to relevant areas of the trains, including those suspected of being in poor condition, to support inspection or to obtain measurements. This may require LU to remove and replace components, flooring, or other panelling prior/post our visits taking place. LU will accommodate free of charge additional reasonable requests for support whilst on a vehicle or worksite, such as the provision of adequate lighting, power, access to office and messing facilities, the provision of fitters or other persons to support survey activities, remove equipment, etc.
8.2 - 197	The 'designer' shall be responsible for making all necessary enquiries and for obtaining all information required to enable it to meet the requirements of this TRS.	We comply, though we will need LU to provide the vehicle information which is at their disposal, and support our achievement of this requirement by facilitating the support of other stakeholders who may hold relevant information – See requirements 195.
8.3 - 2162	The 'designer' shall manage the interfaces between 'modifications' and the 'unmodified train'. Note: this includes interfaces with other works, identified in Section 6.	NB We will require LU to keep us informed of the extent and potential impact of 'the other works' through their involvement in the design development process. It will be for LU to manage suppliers or internal project teams associated with other works on the vehicles. Our scope of work in relation to other programmes will be restricted to the provision of clear interface information and designs which are cognisant of these other works. We will support reviews with other project teams to clarify and resolve any interface conflicts, as required.
	9 FEASIBILITY INVESTIGATION REQUIREMENTS (92TS CENTRAL ONLY)	We comply, though our offer is based on Option 1 only.
10.7 - 2109	The effect of passenger loading in 'wheelchair spaces' on the structural integrity of the car shall be assessed, and, if required, appropriate 'modifications' shall be provided.	We partially comply. Our offer includes an assessment of the structural integrity however to ensure appropriate allocation of risk is based on any mechanical assessments (such as structural or gauging) demonstrating that the proposed modifications can be implemented without undertaking significant structural modifications or changes to the vehicle systems (such as changes to brake or suspension systems).
10.9 - 104 - 2182	Handrails	We comply with the following proviso: Any current handrails that are to be recoated (to a colour that meets LU's requirements) will not be altered in any other way. They will therefore be (aside from their colour) to the current design and current installation arrangements. They will therefore not be regarded as either 'new handrails' or 'modified handrails' and will therefore not be otherwise changed (aside from their colour) to comply with any new requirements (e.g. strength, dimensions or in terms of their fixing) that may be driven by renewal or modification or listed here. Our design will facilitate all handrails currently installed on the 92TS being refurbished, finished in the colours specified by LU and refitted otherwise unchanged to the cars. We will determine as part of our design process whether the handrails can be removed from one position and refitted in the same position in a different car, as may be required. We will, as part of our design, mitigate any potential installation risks associated with the interchangeability of the handrails. At the wheelchair positions, we will design for three modified or new handrails in this area, one handrail adjacent to each wheelchair position and one handrail from the top of the partition behind the transverse wheelchair position to the car roof structure. These handrails will meet the structural and RVAR requirements as specified by LU. We understand that LU are responsible for agreeing RVAR targeted compliance with the DfT and that as part of that process LU will have agreed any exemptions with the DfT. Therefore our offer is made on the basis that the RVAR requirements detailed in LU's TRS for this project, and which we will deliver, are correct and are a match with the targeted compliance agreed between LU and DfT.
10.10.3	PIS integration	NB Achievement of this requirement is subject to the cooperation and performance of the relevant system supplier to LU.
10.10.4	CCTV integration	NB Achievement of this requirement is subject to the cooperation and performance of the relevant system supplier to LU.
10.11 - 63	Modified trains' shall have at least the same area for commercial advertising as 'unmodified trains'.	NB Achievement of this requirement will depend on LU's requirements arising from the feasibility study especially for the 92TS where lighting requirements could potentially drive a compromise on advertising space. This aspect of the design will be managed by agreement with LU through the design review process.
10.12 - 38	Modifications' shall take account of reasonably foreseeable variation in carbody build, including, but not limited to: (a) Car dimension tolerances (b) Vehicle condition	We comply. Our offer is based on all units (for each class) being broadly identical in terms of the interfaces (applicable to our scope of supply) with the systems and modification integration such that a single design solution can be developed to cover each fleet. This relies on early identification of vehicle variants through consultation with the LU teams who understand the detail of the fleet configuration. As far as practicable, the designs produced will allow for adjustment and variation in vehicle build/tolerances and ease of modification associated with condition differences. It is assumed that the Installation Contractor will have a proactive and collaborative approach to dealing with undocumented fleet variances in support of this.
10.13 - 8-407	Car dynamics	We will carry out a Kinematic Envelope (KE) assessment during the Specification stage, in order to confirm whether the gauging envelope of the vehicles will be compromised with the proposed design modifications. This assessment will be restricted to the vehicles which are intended have wheelchair spaces only. NB Our offer is based on LU providing a gauging model for relevant cars and is based on the KE assessment demonstrating that there is no change to the gauging envelope that would necessitate either vehicle modifications or additional work to manage route clearances. Our current offer is based on any mechanical assessments (such as structural or gauging) demonstrating that the proposed modifications can be implemented without undertaking significant structural modifications or changes to the vehicle systems (such as changes to brake or suspension systems).

10.13 - 408	The structural integrity of the 'modified train' and all 'modifications' shall be proven to be structurally fit for purpose in accordance with section 3.10 of S1180 by Finite Element Analysis and/or other suitable calculation method dependent on the extent of modification. Where applicable, analysis shall be in accordance with Appendix B / section 16.1.	NB Due to the design standards for the vehicle in the project differing in some cases from the current standards, we would expect LU to accommodate a level of flexibility in the approach used, noting this will be agreed on a case by case basis.
11.0 - 3	Modifications' shall fulfil all requirements specified in this TRS for a 'design life' of 30 years.	We comply except in the case of corrosion repairs which cannot be offered with a 30 year life as they will be by definition attached to material which is ready many years old. A suitable design life will be proposed and agreed with the LU Engineer for all corrosion repairs during the project delivery.
11.3 - 865 / 495	Modifications' shall fulfil the requirements of BS 6853 for Category 1a vehicles. Note: other Fire Safety Performance requirements in this TRS are in addition to the requirements of BS 6853. / Technical liquids', including electrical components, used in 'modifications' shall be subject to a fire risk assessment, carried out in accordance with G085.	We comply for all elements within our scope of supply. NB Our offer to fulfill this requirement does not extend to the free-issue systems to be installed e.g. PIS / CCTV / LED lighting.
11.3 - 1039 / 502 / 499 / 503	Flat surfaces requiring fire testing shall be subject to toxic fume test B2 in Annex B of BS 6853, having a mass of combustible material (as opposed to inert substrate) of not less than 5g, or (if this mass is impractical) scaled by mass from a B1 test, the latter including sampling of the toxicity of the gases liberated. / Individual items of equipment shall be subjected to fire tests unless: (a) there is an existing, valid entry in the 'approved products register' which is applicable for the specific item and its proposed application, or (b) the items are contained within a container with an adequate degree of fire resistance as defined by BS 6853 / Fire testing on coated and composite materials used in 'modifications' shall be undertaken on the complete assembly. / Where a degree of fire resistance is claimed for a container, it shall be subjected to fire testing sufficient to validate the fire resistance.	We comply, on the basis that the majority of materials specified by ourselves are already in use on LU and hence are expected to already have materials certification in place.
12	Design acceptance	At each design review gateway, LU will provide a single concise list of consolidated feedback comments to be addressed in the following phase (or within reasonable timescales agreed between the parties). On the basis that the feedback raised in this list is managed within the following phase, the following phase will be permitted to continue. Project documentation and approach provided to support the design review process will be cognisant of the required delivery timescales and presented with an appropriate level of detail to ensure clarity of understanding.
13.3.2	13.3.2 The 'designer' shall facilitate updating of updating the Train Maintenance Regime (TMR).	Our scope in this respect will be limited to the provision of any maintenance documentation updates required. It is understood that LU will update the TMR using the information supplied.
13.3.9	The 'designer' shall provide 'Train the Trainer' training and associated training materials to the 'purchaser' for installation and maintenance of the 'modifications'.	Our expectation is that the majority of training requirements will come from the system suppliers (CCTV, PIS, LED Lighting) which is outside of our current scope of supply. For the mechanical modifications, we comply on the basis that training materials for the modifications is minimal due to the mechanical nature of the integration design (i.e. 10 man days total support for preparation of materials and any training provision). If further support is envisaged, we would be pleased to discuss with LU to confirm requirements and update our offer accordingly.
16 - 409	The structural integrity of 'modified cars' shall meet the requirements of category P-III in BS EN 12663. The uncertainty factor S1 shall be 1.15 for proof load cases.	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable, noting that our compliance documentation will be clear that all standards requirements have been considered and if not applicable discounted.
16 - 2100	For assessment of the structural integrity of the 'modified car', the compressive force at buffer level (BS EN 12663 Table 2) shall be 1000kN and the tensile force in coupler area (BS EN 12663 Table 5 and Table 12) shall be 200kN. This load shall also be applied in compression as an additional load case.	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable, noting that our compliance documentation will be clear that all standards requirements have been considered and if not applicable discounted. NB Our scope of work is not regarded as having the potential to impact body structures ability to sustain longitudinal loads. No formal assessment of longitudinal loads on the overall vehicle is included in our offer

16 - 2101 / 2102	A load case shall simulate the car body twist condition corresponding to the derailment of one bogie with the other remaining on flat track: (a) The derailed bogie shall have its secondary suspension acting in its most disadvantageous condition (b) There shall be a vertical difference of 130mm in wheel height between the wheels on one side of the derailed bogie (at rest on sleepers) and the opposite wheels (lodged on a rail) (c) The car body shall be in 'Crush Laden' condition plus a 15% dynamic increment / The car body shall support the total weight of a motored bogie when that load is reacted at the car body trailing end secondary suspension point and the leading end cab anti-over-ride position.	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable, noting that our compliance documentation will be clear that all standards requirements have been considered and if not applicable discounted.
16 - 1618	As far as is practicable, the 'modified train' body structures shall not collapse in an uncontrolled manner as a result of high longitudinal loads encountered during rough couples and collisions as defined in section 3.10.11 of S1180.	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable, noting that our compliance documentation will be clear that all standards requirements have been considered and if not applicable discounted. NB Our scope of work is not regarded as having the potential to impact body structures ability to sustain longitudinal loads. No formal assessment of longitudinal loads on the overall vehicle is included in our offer.
16 - 2103	Fatigue strength shall be demonstrated using a cumulative damage approach and assessed using: (a) BS 7608 with a 2.3% probability of failure for steel structures (b) BS 8118-1 for aluminium structures (c) academically peer-reviewed, data for steel castings	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable, noting that our compliance documentation will be clear that all standards requirements have been considered and if not applicable discounted. NB Our scope of work is not regarded as having the potential to impact overall body resistance to fatigue. No formal assessment of fatigue performance on the overall vehicle is included in our offer.
16 - 2104 / 2105	The damages shall be calculated for each of the following fatigue load cases and the total summed damage for all load cases shall not exceed unity: (a) 100 million cycles of stress fluctuating at $\pm 10\%$ of the vertical stresses for the loading condition of all seated passengers, with no standing passengers (b) 10 million cycles of stress fluctuating at $\pm 10\%$ of the vertical stress for the 'Crush Laden' condition (c) 0.1 million cycles of stress fluctuations caused by a lateral acceleration of $\pm 0.1g$ for the loading condition of all seated passengers, with no standing passengers (d) 2 million cycles of stress fluctuations caused by passenger loading/unloading comprising the following load ranges: See table in ITT (e) stress cycles induced from track twist (twist range is the amount over a 10m base, by which one point of the four is out of plane with the other three) with the following 10m track twist spectrum: See table in ITT / The design mass definitions detailed in section 3.10.2. of S1180 shall be applied.	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable, noting that our compliance documentation will be clear that all standards requirements have been considered and if not applicable discounted.
16 - 1617	The natural modes of vibration of the 'modified car' body, in all operating conditions, shall be separated sufficiently, or otherwise decoupled, from the suspension frequencies, so as to avoid the occurrence of undesirable resonances.	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable, noting that our compliance documentation will be clear that all standards requirements have been considered and if not applicable discounted. NB Our scope of work is not regarded as having the potential to impact natural modes of vibration of the body. No formal assessment of natural modes of vibration of the body is included in our offer.
16.2	LRUs	We comply with respect to modifications within our scope of supply in so far as this requirement is applicable.

Additional assumptions 1	<p>In addition to this clause by clause against the TRS, Wanstead has made a number of additional assumptions which we feel are not clear when presented within our clause by clause response. These assumptions are therefore provided below in order to further clarify our understanding of the scope and approach and to ensure that LU has a clear definition of any boundaries which we believe are important to allow us to achieve the project objectives within the proposed timescales. Should any conflict or confusion arise, the detail within this Section will take precedence over detail within the main offer. This section should be read in conjunction with the TRS, any clarification questions published by LU during the tendering process, our offer and clause by clause.</p> <p>a) Project Management: It is assumed that the design process will be supported by an online portal that is available to all stakeholders for every design stagegate. This is so that all stakeholders have instant access to all the necessary documentation and also so that there is a central depository for all comments from review stages. Such a portal shall be provided by and managed by LU.</p> <p>b) Design: LU will maintain functional system responsibility at all times, and will ensure that the system suppliers provide adequate information into and support to the design process to mitigate the risk of the proposed installation approach preventing adequate system performance. Whilst Wanstead will mechanically interface the systems with the vehicles, our offer assumes that the functional system risks associated with the interfaces (such as compatibility with the train electrical supply, or sufficient electrical capacity being present to support the systems) is managed within the system supply scope. It is assumed that information relating to the systems such as design information, maintenance instructions, RAMS, type and routine test evidence and assurance evidence will be provided directly to LU by each supplier. No independent design, verification and validation activity is anticipated by Wanstead.</p> <p>c) Design: Given that system suppliers have yet to be selected, unless otherwise detailed our offer is based on each system being comparable to a modern equivalent with a centralised "control" module connected through a modern communications backbone to remote visual, audio and Man Machine Interface (MMI) components. No allowance is made for complex distributed system architectures.</p> <p>d) Design: Structural analysis will be conducted where it is the most expedient method. Hand calculations, comparative assessment and Finite Element Analysis will all be used as appropriate to deliver best value and efficiency to LU.</p> <p>e) Design: Our offer is based on spare continuous train wires existing between cars and cabs if required.</p> <p>f) Design: There will be no change to the existing emergency lighting supply configuration.</p> <p>g) Design: LU will facilitate access to all operator, maintainer and union representatives where their input is required to support key HF tasks and analysis. The requirements for liaison with these groups will be defined within the Human Factors (HF) integration plan and managed via liaison with the LU operator, maintainer and customer acceptance managers. The roles and responsibilities of these groups will be clearly defined as part of the HF integration plan.</p> <p>h) Material Supply: Wanstead's supplied components will be warranted for 12 months from installation.</p>
Additional assumptions 2	<p>j) Material Supply: Wanstead will supply, manage and handle all materials for the prototype first in class stages required by LU, but this specifically excludes any free issue materials from LU equipment suppliers.</p> <p>k) Approvals: Wanstead will not be responsible for obtaining LU certification as part of the LU verification process. Wanstead will only provide any relevant evidence (as specified by S1538).</p> <p>l) Installation: As per the requirements presented during the tender presentation and site visits, our offer is for the provision of design and materials only as detailed elsewhere within this offer. No provision is made for the delivery of any installation activities or activities associated with the installation, and all such requirements will be provided by LU.</p> <p>Specific activities which LU will undertake will include:</p> <ul style="list-style-type: none"> • The mobilisation, instruction and management of a labour team • Arrangement of a safe system of work • Procurement of any off-the-shelf tooling or test equipment • Removal and disposal of any materials either permanently or temporarily following the prototype installation • Creation of any hazardous material removal procedures and controls, for cross reference from the vehicle work instructions as required • Delivery of testing activities • The provision of any warranty as required for the activities undertaken <p>m) Installation: Wanstead's engineering resource to support the installation activities will be for a period of up to 8 weeks (40 days) for the 92TS.</p> <p>n) Installation: Wanstead's engineering resource to support the installation activities will be for a period of up to 4 weeks (20 days) for the 72TS.</p> <p>o) Installation: To support the design process, LU will be required to provide specific knowledge of the proposed work sites to ensure that any design solutions can be implemented on the chosen work site and with the chosen installation team.</p>

Appendix 4
Scope of Works