

London Underground Limited (LUL)

Deep Tube Upgrade Programme (DTUP)

One Person Operation (OPO) CCTV System Contract

Section 2

Implementation Work Terms

Schedule 4A

Common Works Information

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 01

Description of the Works

Table of Contents

01.1	General	1
01.2	Glossary	1
01.3	The Deep Tube Upgrade Programme (DTUP)	3
01.4	The OPO CCTV System	3
01.5	OTC – Infrastructure Borne Equipment	4
01.6	Platform Stopping Markers	5
01.7	CDM Compliance	5
01.8	Scope of the Works - OPO CCTV System	5
01.9	Scope of the Works OTC – Infrastructure Borne Equipment	8
01.10	Scope of the Works - Platform Stopping Markers	10
01.11	Integration – <i>Contractor's</i> Works	10
01.12	CAD Drawings	10
01.13	Platform Datum Pins, Setting Out and Verification	11
01.14	Interfaces	13
01.15	Cyber Security	13
01.16	Training & Manuals	13
01.17	Testing Inspection and Commissioning	13
01.18	Spares	13
01.19	Spare Part Packaging	14
01.20	Engineering Information and Submissions	15
01.21	Planned and Other Consents	15
01.22	Damage and Protection	15
01.23	Site Clearance and Cleaning	16
01.24	Security	16
01.25	Management of Works on Site	17
01.26	Miscellaneous	18
	Appendix 01.1 – Not Used	19

01.1 General

- 01.1.1 This Common Works Information (CWI 01) when read with the rest of the Works Information describes the *works* to be provided by the *Contractor* in accordance with these Implementation Works Terms.
- 01.1.2 The *works* are described in terms of the scope and requirements to be met by the *Contractor* and the way in which the *Contractor* shall deliver the *works*, both generally in the context of the Contract as a whole and specifically in relation to these Implementation Works Terms.
- 01.1.3 Not Used
- 01.1.4 The specific scope provisions applicable to the *works* under these Implementation Works Terms are detailed in the Specific Works Information.

01.2 Glossary

The terms and phrases defined in the below table apply to all elements of this CWI 01.

Term	Definition
CDM	The Construction (Design and Management) Regulations 2015 including any approved code of practice and any guidance requirements issued by the Health and Safety Executive (CDM 2015).
Correct Side Door Enable (CSDE)	equipment to ensure that the train doors can only be opened on the side adjacent to the platform and when the train is stopped within a defined tolerance of the Platform Stopping Position.
Cyber Security	has the meaning given to that term in the Cyber Security Schedule of the General Terms.
Deep Tube Upgrade Programme (DTUP)	a co-ordinated series of line upgrades for the Piccadilly, Central, Bakerloo and Waterloo & City lines of the London Underground network.
Design Governance Board	<i>Employer's</i> internal review group that will review and endorse overall installation principles and design approach for installation of Infrastructure-borne equipment as a part of OPO CCTV System.
Design Working Group	the working group of the <i>Employer's</i> Design Governance Board.
Infrastructure Borne Assets	those elements of the OPO CCTV System that installed within the station.
Interface Control Document (ICD)	The document created in accordance to Schedule 9 Implementation Works Terms – Systems Engineering, Integration and Interface Schedule to describe the interaction between two (2) or more technical elements of the DTUP, to be delivered by two (2) or more PDPs.
LUL Network Integration Testing	LUL Network Integration Testing is undertaken to demonstrate compatibility of the new train with both existing

	and newly installed systems. LUL Network Integration Testing will be undertaken during Engineering Hours.
Obsolescence Strategy	the strategy prepared by the <i>Contractor</i> that complies with British Standard BS EN 62402:2007 'Obsolescence Management - Application Guide' and LU TfL Standard S1043 Obsolescence Management.
OPO CCTV System	OPO CCTV is a system specifically designed and used for the capture of near real time images of the Platform Train Interface for display in the train cab, in order that the train operator can mitigate ALARP, the risks for safe departure of the train from the platform in all driving modes, in any direction.
OTC - Infrastructure Borne Equipment	is the OTC System equipment that is mounted on the infrastructure. The OTC – Infrastructure Borne Equipment is designed and free issued by the Rolling Stock Manufacture. The OTC System provides the following functionality: <ul style="list-style-type: none"> a) Correct Side Door Enable (CSDE) functionality ensuring that the train doors can only be opened on the side adjacent to the platform and when the train is stopped within a defined tolerance of the Platform Stopping Position; and b) Two-way communications link to allow the transfer of data/commands to and from the train while berthed at the platform.
PDP	"Project Delivery Partner" or "PDP" means an organisation (whether external to or internal within the <i>Employer's</i> organisation who is contracted to deliver any or all projects associated with the DTUP, including the <i>Contractor</i> .
Platform Datum Pins	a datum pin provided on every platform by the <i>Employer</i> to facilitate setting out of the works.
Platform Stopping Markers	Platform Stopping Markers consist of rectangular plates bearing a series of chevron markings to facilitate a train operator stopping at the Platform Stopping Position.
Platform Stopping Position (PSP)	The Platform Stopping Position is the designated nominal stopping position for the New Train and is used as the datum to determine the position of the Train for design, installation, testing and commissioning of the OPO CCTV System. PSPs for each platform will be shown on drawings issued as part of the Works Information. The Platform Stopping Position is referenced from a datum point at the Platform Datum Pin at the leading end of the train in the direction of departure for a normal move. Dimensions on the drawings are +ve in the direction of travel of the train for a normal move; dimensions to features in the platform are therefore generally shown as -ve on the CAD drawings. Dimensions are taken along the centreline of the track, taken perpendicular from the track centreline.
Platform Train Interface (PTI)	The area where the platform and train interface, which is normally accessible to customers.
Radio Frequency	uses electromagnetic fields to automatically identify and

Identification (RFID)	track tags attached to objects. The tags contain electronically-stored information.
Rolling Stock Manufactures Test Track	the test facilities provided by the rolling stock manufacture for integration testing of the train with equipment and systems provided by PDP's.
Station Supervisor	the supervisor responsible for a LU station.
Technical Information	means information and materials required by the <i>Employer</i> in order to operate the OPO CCTV System and the installation of OTC Infrastructure Equipment and Stopping Markers and shall include but are not limited to: <ul style="list-style-type: none"> (a) all calculations, analyses, information and interface information, drawings, records (including design, manufacture, installation, test, commissioning, maintenance and operational records) and data and Documentation; (b) all safety cases, assurance information, approvals (including restrictions on use), hazard and safety risk logs, verification and validation records; (c) the operating and maintenance manuals; and (d) all training materials.
Train Borne Assets	those elements of the OPO CCTV System that installed on the DTUP passenger train.
Train Borne Equipment	the components of the OPO CCTV System, within the <i>Contractor's</i> scope that are installed on the train.

01.3 The Deep Tube Upgrade Programme (DTUP)

01.3.1 The provision of new trains and supporting systems including One Person Operation (OPO) CCTV is a key element in the DTUP which comprises the complete modernisation of four (4) London Underground lines: the Piccadilly, Waterloo & City, Bakerloo and Central lines. The *works* include the Piccadilly Line Order and Bakerloo Line Option (if enacted by the *Employer*).

01.3.2 In addition to the OPO CCTV System, the *works* also include the design of fixing(s) and the installation of the following:

- a) The Off-Train Communications (OTC) system - Infrastructure Borne Equipment; and
- b) The Platform Stopping Markers.

01.3.3 A high level description of the OPO CCTV System, OTC - Infrastructure Borne Equipment and the Platform Stopping Markers is provided in the following three sections, before defining the outline scope of works for each.

01.4 The OPO CCTV System

01.4.1 Platform Train Interface (PTI) is the *Employers* top safety risk due to the lack of any physical separation between the passengers on the platforms and moving trains. Since the impact of this risk is possible passenger fatality, mitigations are carefully developed and prescribed in various TfL Standards. The primary mitigation of the PTI risk during train dispatch is provision of clear and uninterrupted view of the complete critical area of the PTI to the

train operator. Current best practice is for this to be achieved by an OPO CCTV System utilising a track to train transmission system to display real time images from platform mounted cameras to the train operator in the cab.

01.4.2 The OPO CCTV System is comprised of three (3) subsystems:

Imaging subsystem - comprises station based equipment which includes:

- a) The camera installations including their supports, power and signal cables;
- b) The amplification, and processing equipment to create combined platform video stream of the PTI for transmission to the trains and, when required, to other locations such as control rooms; and
- c) Video recording of the processed-combined images and the un-processed images from the individual cameras.

Transmission subsystem:

Receives the video stream from the processing equipment and encodes, it for transmission to the train via a leaky feeder cable. The train receives the video stream via antennas. This video stream is then decoded and fed to the display subsystem.

Display subsystem:

The display system consists of a pair of monitors in the cab for displaying the video stream to the train operator.

01.5 OTC - Infrastructure Borne Equipment

01.5.1 The OTC System provides the following functionality:

- a) Correct Side Door Enable (CSDE) functionality ensuring that the train doors can only be opened on the side adjacent to the platform and when the train is stopped within a defined tolerance of the Platform Stopping Position; and
- b) Two-way communications link to allow the transfer of data/commands to and from the train while berthed at the platform.

01.5.2 The functionality will be provided by the following OTC Infrastructure Borne Equipment:

- a) A series of Radio Frequency Identification (RFID) tags mounted either on the track, or platform face will provide the CSDE functionality; and
- b) Wi-Fi routers, equipment located within an equipment room and associated power and data cabling.

Note: The Wi-Fi antenna may be located on the approach to, and exit from, each platform and could be up to 100m from nearest head/tail wall / top of ramp.

01.6 Platform Stopping Markers

- 01.6.1 Platform Stopping Markers consist of rectangular plates bearing a series of chevron markings to facilitate a train operator stopping at the Platform Stopping Position.
- 01.6.2 In the shortest deep tube platforms the Platform Stopping Markers will be located a few metres inside the running tunnel.

01.7 CDM Compliance

- 01.7.1 The *Contractor* shall undertake the roles of Principal Designer, Designer and Principal Contractor roles under CDM 2015 in accordance with CWI 19 Health and Safety and ensure safe system of work for all elements of the *works*.

01.8 Scope of the Works – OPO CCTV System

- 01.8.1 The Rolling Stock Manufacturer provides the monitors and cabling installed on the DTUP passenger train.
- 01.8.2 The technical interfaces between the *Contractor* and the Rolling Stock Manufacturer shall be managed in accordance with the processes described in Schedule 9 of the Implementation Works Terms.
- 01.8.3 **System Design**
- 01.8.3.1 The *Contractor* shall undertake the overall system design of the OPO CCTV System with input from the Rolling Stock Manufacturer.
- 01.8.3.2 The *Contractor* shall select frequencies for the track to train CCTV transmission from the range specified in CWI 05 Technical Requirements and shall obtain and transfer to the *Employer* any licences necessary for the radio frequencies chosen.
- 01.8.3.3 The *Contractor* is responsible for achieving incremental acceptance from the *Project Manager* for the overall system design in accordance with CWI 07 Testing, Inspection and Commissioning, thereby, enabling detailed design to commence on individual elements of the system ahead of the final acceptance of the System Design.
- 01.8.3.4 Final acceptance of the system level design will be achieved following satisfactory testing at the Rolling Stock Manufacturer's Test Track and the testing of the overall system latency in accordance with CWI 07 Testing, Inspection and Commissioning.
- 01.8.3.5 The System Design shall also include the detailed design of generic components including, but not limited to the following:
- a) Equipment cabinets/power supplies;
 - b) Station based transmission equipment;
 - c) Train based transmission receiving equipment; and
 - d) Generic camera brackets, post, foundations/fixing arrangements.

01.8.4 Station specific works

- 01.8.4.1 The *Contractor* shall undertake the design, installation and testing and commissioning of the station specific works for the OPO CCTV System.
- 01.8.4.2 The *Contractor* shall utilise the Communications Equipment Room (CER) space reserved by the *Employer* as detailed in Specific Works Information SWI 02 Constraints on the method, order and timing of the works.
- 01.8.4.3 The design for the station specific works for the OPO CCTV System includes, but is not limited to the following:
- a) Imaging system design (per platform)
 - i. Preliminary Surveys;
 - ii. Concept Design (Image Capture); and
 - iii. Conceptual Design Validation (Image Capture).
 - b) Installation design
 - i. Camera installation;
 - ii. Equipment room installation;
 - iii. Leaky feeder installation; and
 - iv. Cabling and containment.
- 01.8.4.4 Wherever possible the *Contractor* shall utilise existing Cable Route Management Systems (CRMS) in accordance with CWI 05 Technical Requirements. Evidence of compliance with this requirement will be required to support the design review and acceptance process.
- 01.8.4.5 Where it is not practicable to utilise the existing CRMS, the *Contractor* shall design and install CRMS.
- 01.8.4.6 All cable management and ducting within the equipment rooms, including the cable entry from the outside environment into the room, shall be the responsibility of the *Contractor*.
- 01.8.4.7 The *Contractor's* design shall take cognizance of all known asbestos and avoid such areas (where possible). Asbestos records are included as Site Information.
- 01.8.4.8 Testing and commissioning of the station specific works for the OPO CCTV System shall be in accordance with CWI 07 Testing, Inspection and Commissioning. Testing and Commissioning is undertaken in two (2) phases:
- a) The Initial Testing and Commissioning on the completion of the installation of the station specific works; and
 - b) Final Testing and commissioning not more than three (3) weeks prior to LU Network Integration Testing for a specific station, or platform.
- 01.8.4.9 Following satisfactory completion of the Initial Testing and Commissioning for each individual platform, the *Contractor* shall leave the station specific works for the OPO CCTV System turned on. The period between the Initial and Final Testing and Commissioning shall act as a reliability growth period.

- 01.8.4.10 For the period between the Initial and Final Testing and Commissioning's the *Contractor* shall notify the *Project Manager*, of any failures, or defects notified by the OPO CCTV System condition monitoring. For the avoidance of doubt the *Contractor* during this period shall not attend the station, or take any other action unless instructed by the *Project Manager*.
- 01.8.4.11 The *Contractor* shall cooperate with the *Employer*, other PDPs and Others to support the LUL Network Integration Testing at each platform in accordance with CWI 07 Testing, Inspection and Commissioning.
- 01.8.5 **Train Bourne Equipment**
- 01.8.5.1 The *Contractor* shall undertake the design, manufacture and testing of the Train Bourne Equipment for the OPO CCTV System in accordance with the requirements of the Works Information.
- 01.8.5.2 The *Contractor's works* for Train Bourne Equipment are limited to antennas and decoding/amplifying equipment. For the avoidance of doubt, all bracketry, equipment racks, cabling and connectors are provided by Others.
- 01.8.5.3 Testing of the Train Bourne Equipment includes the specific testing requirements specified in CWI 05 - Technical Requirements in addition to those specified in CWI 07 Testing, Inspection and Commissioning.
- 01.8.5.4 The *Contractor* shall support the Rolling Stock Manufacturer with the testing to ensure Train Bourne Equipment successfully integrates with the rolling stock. This will necessitate the supply of both Train Bourne Equipment and components of the station based equipment. The details related to the equipment, the delivery location and timing shall be agreed with the Rolling Stock Manufacture via the Interface Control Document.
- 01.8.5.5 The *Contractor* shall deliver one (1) full set and one (1) spare set of Train Bourne Equipment for the each of the two (2) pre-series trains to the Rolling Stock Manufacturer's Facility in Vienna by Key Date KD1.
- 01.8.5.6 The *Contractor* shall provide on-site support to Rolling Stock Manufacturer for the testing and commissioning Train Bourne Equipment on the two (2) pre-series trains at the Rolling Stock Manufactures Facility in Vienna. The timing shall be agreed with the Rolling Stock Manufacturer via the Interface Control Document.
- 01.8.5.7 The *Contractor* shall agree the delivery schedule of Train Bourne Equipment for the series production trains with the Rolling Stock Manufacturer via the Interface Control Document. The delivery location will be the Rolling Stock Manufacturer's Facility in Vienna.
- 01.8.6 **Rolling Stock Manufactures Test Track**
- 01.8.6.1 In order to facilitate integration testing, the Rolling Stock Manufacturer will construct a length of temporary platform at the test track.
- 01.8.6.2 The Rolling Stock Manufacturer will supply track geometry and a schematic drawing of the platform by the dates specified in SWI 01 Description of the Works.
- 01.8.6.3 The *Contractor* shall design a representative OPO CCTV System installation with up to four (4) cameras. The Rolling Stock Manufacturer will review and comment on the design. The *Project Manager* will accept the design.

- 01.8.6.4 The *Contractor* shall complete the installation at the test track between the dates specified in SWI 01 Description of the Works.
- 01.8.6.5 The *Contractor* shall be present for the relevant integration testing in accordance CWI 07 Testing, Inspection and Commissioning. The expected dates for these tests are specified in SWI 01 Description of the Works.
- 01.8.6.6 The *Contractor* shall recover the OPO CCTV System installation from the Rolling Stock Manufacturer's Test Track upon completion of all testing activities. The *Contractor* shall agree the date(s) and access with the Rolling Stock Manufacturer.

01.9 Scope of the Works OTC - Infrastructure Borne Equipment

01.9.1 Rolling Stock Manufacturers Scope

- 01.9.1.1 The system level design of the OTC System will be undertaken by the Rolling Stock Manufacturer.
- 01.9.1.2 The Rolling Stock Manufacturer will be the Lead Project Delivery Partner for this interface and shall be responsible for developing and agreeing the technical interfaces via an Interface Control Document (ICD).
- 01.9.1.3 The Rolling Stock Manufacturer will provide a technical specification detailing the installation of the OTC – Infrastructure Borne Equipment, relevant tolerances, testing procedures and if required any specialist test equipment and, or tools. This will be available by the dates specified in SWI 01 Description of the Works.
- 01.9.1.4 The Rolling Stock Manufacturer will review and validate the *Contractor's* OTC – Infrastructure Borne Equipment installation design for the first station. The *Project Manager* will review and accept the *Contractor's* OTC – Infrastructure Borne Equipment installation design for all stations. The *Project Manager* will not unreasonably withhold acceptance of the installation design.
- 01.9.1.5 The Rolling Stock Manufacturer will deliver the OTC - Infrastructure Borne Equipment to a location agreed with the *Contractor*.
- 01.9.1.6 The Rolling Stock Manufacturer will provide on-site support to the *Contractor* for the installation, testing and commissioning of the OTC – Infrastructure Borne Equipment at the first station.

01.9.2 Contractor's Scope

- 01.9.2.1 The *Contractor* shall receive free issue OTC – Infrastructure Borne Equipment consisting of but not limited to the following:
- a) Radio Frequency Identification (RFID) tags;
 - b) Wi-Fi router(s), equipment and associated power supply.
- 01.9.2.2 For the avoidance of doubt the *Contractor's works* include all other cabling, brackets, fixings and fastenings, etc. comprising of the OTC – Infrastructure Borne Equipment installation.
- 01.9.2.3 The *Contractor* will not be required to connect the OTC – Infrastructure Borne Equipment to the *Employers* data network.

- 01.9.2.4 The *Contractor* shall cooperate with the Rolling Stock Manufacturer on the development of the ICD for the OTC System in accordance with the process described in Schedule 9 of the Implementation Works Terms.
- 01.9.2.5 The *Contractor* shall undertake the installation design for the OTC – Infrastructure Borne Equipment in accordance with the technical specification provided by the Rolling Stock Manufacturer referenced in paragraph 01.9.1.3 above. The general installation design shall comply with the Works Information and specifically the Installation Section of CWI 05 Technical Requirements.
- 01.9.2.6 The *Contractor* shall utilise the Communications Equipment Room (CER) space reserved by the *Employer* as detailed in Specific Works Information SWI 02 Constraints on the Method, Order and Timing of the Works.
- 01.9.2.7 Wherever possible the *Contractor* shall utilise existing Cable Route Management Systems (CRMS) in accordance with CWI 05 - Technical Requirements. Evidence of compliance with this requirement will be required to support the design approval.
- 01.9.2.8 Where it is not practicable to utilise the existing CRMS, the *Contractor* shall design and install CRMS.
- 01.9.2.9 All cable management and ducting within the equipment rooms, including the cable entry from the outside environment into the room, shall be the responsibility of the *Contractor*.
- 01.9.2.10 The *Contractor's* design shall take cognizance of all known asbestos and avoid such areas (where possible). Asbestos records are included as Site Information.
- 01.9.2.11 For the first station the *Contractor* shall co-ordinate with and obtain the Rolling Stock Manufacturer's concurrence of the OTC – Infrastructure Borne Equipment installation design prior to submitting the design to the *Project Manager* for acceptance.
- 01.9.2.12 The *Contractor* shall install the OTC – Infrastructure Borne Equipment in accordance with the technical specification provided by the Rolling Stock Manufacturer.
- 01.9.2.13 The *Contractor's* shall cooperate with the Rolling Stock Manufacturer for support to the *Contractor* for the installation, testing and commissioning of the OTC – Infrastructure Borne Equipment at the first station.
- 01.9.2.14 Testing and commissioning of the station specific works for the OTC – Infrastructure Borne Equipment shall be in accordance with the technical specification provided by the Rolling Stock Manufacturer and in accordance with CWI 07 Testing, Inspection and Commissioning. Testing and Commissioning shall be undertaken in two phases:
- a) The Initial Testing on the completion of the installation of the station specific works; and
 - b) Final Testing and commissioning not more than three (3) weeks prior to LUL Network Integration Testing for a specific station, or platform.
- 01.9.2.15 The *Contractor* shall cooperate with the *Employer*, other PDPs and others to support the Network Integration Testing at each platform in accordance with CWI 07 Testing, Inspection and Commissioning.

01.10 Scope of the Works – Platform Stopping Markers

01.10.1 Employers Scope

- 01.10.1.1 The design of the Platform Stopping Marker will be undertaken by the *Employer* in consultation with the Rolling Stock Manufacturer.
- 01.10.1.2 The *Employer* will be the Lead Project Delivery Partner for this interface with the *Contractor*.
- 01.10.1.3 The *Employer* will provide a technical specification and tolerances for the installation of the Platform Stopping Markers by dates specified SWI 01 Description of the Works.
- 01.10.1.4 The *Project Manager* will arrange delivery of the Platform Stopping Markers to a location within the M25 nominated by the *Contractor*.

01.10.2 Contractor's Scope

- 01.10.2.1 The *Contractor* shall receive Platform Stopping Markers free issued by the *Employer*.
- 01.10.2.2 For the avoidance of doubt, the *Contractor's works* include the design, supply and installations of all brackets, fixings and fastenings, etc. comprising of the Platform Stopping Marker installation.
- 01.10.2.3 The *Contractor* shall cooperate with the *Employer* on the development of the ICD for the Platform Stopping Markers in accordance with the process described in Schedule 9 of the Implementation Works Terms.
- 01.10.2.4 The *Contractor* shall undertake the location specific design (and installation) of the Platform Stopping Markers in accordance with the technical specification provided by the *Employer*.
- 01.10.2.5 Testing and commissioning of the Platform Stopping Markers shall be in accordance with CWI 07 Testing, Inspection and Commissioning.
- 01.10.2.6 The *Contractor* shall cooperate with the *Employer*, other PDPs and others to support the Network Integration Testing at each platform in accordance with CWI 07 Testing, Inspection and Commissioning.

01.11 Integration - Contractors Works

- 01.11.1 The *Contractor* shall produce a single coordinated design for the station specific works for the OPO CCTV System, the OTC – Infrastructure Borne Equipment and Platform Stopping Position Markers.
- 01.11.2 The *Contractor* shall seek to maximise efficiencies through the design of and installation of the station specific works for the OPO CCTV System, the OTC – Infrastructure Borne Equipment and Platform Stopping Position Markers.

01.12 CAD Drawings

- 01.12.1 The *Employer* will provide CAD of every platform after the Order Commencement Date.
- 01.12.2 The CAD drawings include the track geometry, DTUP passenger trains and the location of the Platform Datum Pins.

- 01.12.3 The *Contractor* shall use the CAD drawings as the basis for the design of the OPO CCTV System station specific works, the OTC – Infrastructure Borne Works and Platform Stopping Markers.

01.13 Platform Datum Pins, Setting Out and Verification

- 01.13.1 The *Employer* provides Platform Datum Pins at every platform. In the unlikely event that the *Contractor* identifies a missing or damaged Platform Datum Pin(s), the *Contractor* shall notify the *Project Manager* immediately so that the *Project Manager* can arrange for a replacement to be installed.
- 01.13.2 The *Contractor* shall utilise the Platform Datum Pins for determining the position of OPO CCTV Cameras, OTC – Infrastructure Borne Equipment RFID tags, Stopping Markers, etc.
- 01.13.3 The *Contractor* shall utilise the appropriate methodology from those specified in the following five sections.
- 01.13.4 In all cases it is essential that the linear dimension shall be taken from the CAD drawing along the platform edge or running rail and not as a cord between the two points.
- 01.13.5 Not Used
- 01.13.6 Not Used

01.13.7 Setting Out – Platform Area

- 01.13.7.1 Measurements to the required locations along the platform shall be made from the Platform Datum Pin using a calibrated 30m tape, along the top edge of the platform. (Where platform humps exist, measurements to be made along the continuous lower level edge of platform, not over the platform hump).
- 01.13.7.2 Where the position of the equipment to be located at rear of platform, or barrier away from platform edge, the centre point of the equipment shall be located using a 5-point laser at marked location on edge of platform to project laser line perpendicular from platform edge on to back of platform wall.
- 01.13.7.3 The height of the equipment shall be determined by measuring up from finished floor level at the location resolved by the methodology specified in 01.13.7.1 and 01.13.7.2 above using calibrated measuring staff.

01.13.8 Setting Out – Tunnel Wall Opposite Platform (Deep Tube & Cut-and-Cover Near Heathrow)

- 01.13.8.1 The following methodology shall be utilised when setting out Stopping Markers (and other equipment) on the tunnel wall within the platform area.
- 01.13.8.2 Measurements to the required locations along the platform shall be made from the Platform Datum Pin using a calibrated 30m tape, along the top edge of the platform. (Where platform humps exist, measurements to be made along the continuous lower level edge of platform, not over the platform hump).
- 01.13.8.3 A 5-point laser shall be located at the marked location on the platform edge to project laser line perpendicular from platform edge on to back of platform

wall.

- 01.13.8.4 The height of the equipment shall be determined by measuring up from projected laser line on the wall taking the height of the laser into account.

01.13.9 Setting Out – RFID Tags (OTC – Infrastructure Borne Equipment)

- 01.13.9.1 The following methodology shall be utilised to when setting out RFID tags in the 4-foot.

01.13.9.2 A 5-point laser shall be used at the edge of the platform, at the location of the Platform Datum Pin, to project a laser line onto a builders level held vertically on the running rail nearest to the platform, and this position marked.

01.13.9.3 Measurements to the required locations for the RFID tags shall be made along the running rail using a calibrated 30m tape.

01.13.10 Setting Out – Stopping Markers Located on Posts Opposite a Platform

01.13.10.1 The following methodology shall be utilised to when setting out Stopping Markers on posts opposite a platform.

01.13.10.2 A 5-point laser shall be used at the edge of the platform, at the location of the Platform Datum Pin, to project a laser line onto a builders level held vertically on the running rail nearest to the platform, and this position marked.

01.13.10.3 Measurements to the required locations for Stopping Markers shall be made along the running rail using a calibrated 30m tape.

01.13.10.4 A 5-point laser shall be located at the marked location on the running rail and used to project laser line perpendicular to the rail onto a post.

01.13.10.5 The height of the equipment shall be determined by measuring up from projected laser line taking the height of both the platform and the laser into account.

01.13.11 Setting Out – Stopping Markers and WiFi Antenna are Located on Posts Opposite or Tunnel Wall Outside of the Platform Area

01.13.11.1 A 5-point laser shall be used at the edge of the platform, at the location of the Platform Datum Pin, to project a laser line onto a builders level held vertically on the running rail nearest to the platform, and this position marked.

01.13.11.2 Measurements to the required locations for Stopping Markers or Wi-Fi antenna shall be made along the running rail using a calibrated 30m tape.

01.13.11.3 A 5-point laser shall be located at the marked location on the running rail and used to project laser line perpendicular to the rail onto a post or tunnel wall

01.13.11.4 The height of the equipment shall be determined by measuring up from projected laser line taking the height of both the platform and the laser into account.

01.13.12 Validation of as Installed Location

01.13.12.1 The *Contractor* shall validate that all OTC – Infrastructure Borne Equipment RFID tags and Stopping Markers have been installed in their designed locations.

01.13.12.2 The *Contractor* shall utilise the methodologies specified in 01.13.8, 01.13.9, 01.13.10 and 01.13.11 for the validation.

01.13.12.3 The *Contractor* shall supply dimensioned sketches to show installed OTC – Infrastructure Borne Equipment RFID tags and Stopping Markers with dimensions relative to the Platform Datum Pin to centimetre accuracy.

01.13.12.4 The *Employer* will undertake representative check sampling of data supplied on the sketches specified in 01.13.12.3 to ensure compliance with accuracy requirements.

01.14 Interfaces

01.14.1 In addition, to the specific requirements noted in this CWI 01 for station specific works the *Contractor* shall manage all Interfaces in accordance with Schedule 9 Implementation Works Terms – Systems Engineering, Integration and Interface Schedule.

01.15 Cyber Security

01.15.1 The *Contractor* shall comply with the Cyber Security requirements of the General Terms and the specific Technical Requirements specified in CWI 10 in relation to the Cyber Security of the OPO CCTV System.

01.15.2 The *Contractor* has no Cyber Security obligations in relation to the OTC – Infrastructure Borne Equipment.

01.16 Training & Manuals

01.16.1 The *Contractor* is not required to undertake training, or produce manuals in relation to the installation of OTC – Infrastructure Borne Equipment and Platform Stopping Markers.

01.16.2 The *Contractor* shall provide the necessary Technical Information to the Rolling Stock Manufacturer relating to the trainborne OPO equipment to enable the Rolling Stock Manufacturer to develop comprehensive manuals, training materials for the DTUP Rolling Stock. This shall be managed in accordance the processes described in Schedule 9 of the Implementation Works Terms – Systems Engineering, Integration and Interface Schedule.

01.16.3 The *Contractor* shall provide training specified in SWI 09 Training in accordance with the requirements specified in CWI 09 Training.

01.17 Testing Inspection and Commissioning

01.17.1 Testing of the communication network shall be completed by the *Contractor* as set out in CWI 07 Testing, Inspection and Commissioning and elsewhere in the Works Information.

01.18 Spares

01.18.1 The *Contractor* shall determine the minimum stock levels for both Infrastructure Borne Assets and Train Borne Assets in order to achieve the System Reliability required in CWI 05 Technical Requirements and SWI 05 Technical Requirements. When determining the minimum stock levels, the

Contractor shall factor in an additional 10% of Train Borne Assets being faulty due to damage and vandalism.

- 01.18.2 The *Contractor* shall manufacture, maintain and store the required Spares for the Operational Service Terms until the Operational Services Commencement Date.
- 01.18.3 All spares provided by the *Contractor* shall be identical to and interchangeable with the items originally supplied except to the extent that configuration is required for use at an individual platform or unless otherwise accepted by the *Project Manager*.
- 01.18.4 All spares supplied by the *Contractor* will be modified by the *Contractor* to the latest revision in the event of a correction of a Defect, from manufacture of the Spares to end of the *defects date*.
- 01.18.5 All spares supplied by the *Contractor* that become obsolete before the *defects date* shall be replaced by the *Contractor* with the alternative part determined as part of the Obsolescence Strategy.
- 01.18.6 All spares supplied by the *Contractor* shall be uniquely identified in a manner to be agreed with the *Project Manager*.

01.19 Spare Part Packaging

- 01.19.1 Spares shall be suitably packaged for storage and shall be suitably and individually labelled to indicate:
- a) shelf life and date of manufacture;
 - b) type or condition(s) of storage and special handling information;
 - c) description of item and relevant part number;
 - d) serial number, if applicable;
 - e) inspection/test certificate number and batch number;
 - f) contract number, item number and specific order reference (if applicable); and
 - g) weight.
- 01.19.2 Tube ends and other similar openings shall be blanked off to prevent ingress of dirt or moisture. Flanged ends shall be protected by adhesive tape or jointing material covered by a properly secured wooden blank not smaller than the flange itself. Plain tube ends shall be closed off with bungs or plugs or suitable materials firmly fixed in position.
- 01.19.3 Fragile Spares shall be packed in such a way to prevent damage during delivery and when unpacked for quality inspection shall be easily re-packable using the original wrappings or packing for long-term storage within the same packing case.
- 01.19.4 All electrostatic sensitive devices and modules shall be supplied in suitable electrostatic device protective packaging compliant with the applicable parts of Standard IEC 61340-5-1:2016.
- 01.19.5 Appropriate precautions in accordance with the *Contractor's* safety

requirements and, the Standards and safety requirements of the *Employer*, and all applicable laws shall be taken by the *Contractor* in respect of all hazardous, toxic or inflammable materials.

01.20 Engineering Information and Submissions

01.20.1 The *Contractor* shall manage all Technical Information related to the provision of the *works* in accordance with CWI 06 - Engineering Management and Cyber Security Schedule of the General Terms.

01.20.2 All Technical Information produced in delivering the *works* or described in the Works Information shall be made available to the *Project Manager* in accordance with CWI 11 - Information Management. The *Contractor* shall ensure that the Technical Information is accessible by the *Employer* at any time from any computer connected to the TfL Intranet without requiring any additional Software above that usually provided on an industry standard PC (Wintel environment).

01.21 Planning and Other Consents

01.21.1 The *Contractor* shall assess with the *Project Manager* if the works will require any additional permitted development rights or planning consent application, and notify the *Project Manager* accordingly.

01.21.2 The *Employer* is responsible for obtaining all planning approvals required for the *works*, so as to meet the requirements of the Accepted Programme. If the *Employer* cannot obtain the required approvals due to the *Contractor's* proposals for the *works*, then the *Contractor* shall revise its proposals such that approval can be obtained.

01.21.3 Given the age of many parts of the LUL Network, some locations have heritage status, including listing by London Underground, Local Authorities and Historic England – these are listed in Specific Works Information. In these locations any consents required for the installation of physical assets necessary to complete the *works* will be sought by the *Employer*.

01.21.4 The *Contractor* shall provide design information to support the heritage consent process and shall state in the Accepted Programme the dates by which it requires the *Employer* to have obtained any required heritage consents and/or approvals.

01.21.5 The *Employer's* internal Design Governance Board (DGB) and the associated Design Working Group will review and endorse overall installation principles and design approach for installation of Infrastructure-borne equipment as a part of OPO CCTV System.

01.21.6 The *Contractor* shall provide design information to support the Design Governance Board review process and shall state in the Accepted Programme the dates by which it requires the *Employer* to obtain consents and/or approvals.

01.22 Damage and Protection

01.22.1 The *Contractor* shall not carry out any *works* that are liable to damage the stability of the *works* and or adjoining buildings. No cutting through floors,

roofs or walls will be permitted except as shown on the design drawings and accepted by the *Project Manager*.

01.22.2 The *Contractor* shall protect from damage the adjoining buildings and premises and shall make good as soon as practicable all damage done through the carrying out of the *works*.

01.22.3 The *Contractor* shall bear the cost of any making good required following damage to the structures, services, or finishes of the *Employer's* or *Other's* premises.

01.22.4 The *Contractor* shall protect his elements of the *works*.

01.22.5 The *Contractor* shall protect the *works* from inclement weather, public or staff access, accidental damage by third parties or its own operatives, in whichever form is required.

01.23 Site Clearance and Cleaning

01.23.1 The *Contractor* shall collect and remove at the end of each shift within the LUL Network, all equipment (e.g. including but not limited to: building appliances, apparatus or tools, surplus materials, together with all rubbish and debris).

01.23.2 The *Contractor* shall provide a formal handover procedure for acceptance by the *Project Manager*.

01.23.3 The station bin store shall not to be used by the *Contractor*.

01.23.4 At the end of each shift within the LUL Network the *Contractor* shall clear the working areas of all surplus materials and equipment and shall reinstate the areas to their condition existing prior to the *Contractor's* occupation of those areas.

01.23.5 The *Contractor* shall be responsible for the removal of waste materials from the *site*.

01.24 Security

01.24.1 Security Vetting

01.24.1.1 The *Contractor's* staff and its *Subcontractor's* staff requiring access to the Site shall be subject to an enhanced security check through the Disclosure and Barring Service (DBS) - <https://www.gov.uk/db-check-applicant-criminal-record>. These checks shall be performed and clearance obtained prior to any staff being allowed to work in these areas.

01.24.1.2 The *Contractor* shall provide sufficient numbers of security cleared staff to deliver the *works* without disruption.

01.24.1.3 The *Contractor* shall provide details of security cleared staff to the *Project Manager* on a periodic basis and shall keep full records of all clearances and rejected clearances.

01.24.2 Security Passes

01.24.2.1 *Contractor's* and *Subcontractor's* staff shall wear a relevant security pass and/or *Contractor* pass at all times when on the Site or at the *Employers*

office. Where the *Employer* does not provide such passes to the *Contractor's* staff, the *Contractor* shall implement its own security pass arrangements that shall be accepted by the *Project Manager* in advance. As a minimum, the *Contractor* provided security pass shall include the staff member's name, photograph and an expiry date. This requirement does not replace and is in addition to any specific *Employer* entry permits issued as part of a training course which may be required for certain parts of the Site.

01.24.3 Keys and Access

01.24.3.1 When required, keys and access cards (including other methods of controlled access) will be provided to the *Contractor*. The *Contractor* shall be responsible for the safe keeping of such keys and access cards. The *Contractor* shall not manufacture duplicate keys and access cards under any circumstances. The *Contractor* shall return to the *Employer* all keys and access cards that have been issued on completion of any specific section of works for which keys and access cards have been issued.

01.24.3.2 Should the *Contractor* lose any key or access card provided by the *Employer* then immediately on discovery of the loss, the *Contractor* shall:

- a) notify the *Employer* of the loss;
- b) provide a loss report; and
- c) pay to the *Employer* the cost of replacement of the key(s) or card(s) including any associated installation work.

01.25 Management of Works on Site

01.25.1 The *Contractor* shall provide temporary hoardings should they be required in the delivery of the *works*. The *Contractor* shall construct temporary hoardings in accordance with TfL Standard S1027 Site Hoarding, Fencing and Barriers.

01.25.2 The *Contractor* shall protect existing structures from damage during the delivery of the *works* by the use of any necessary props, screens, fans, waterproof sheets, dust sheets and the like, and any damage caused shall be made good by the *Contractor*.

01.25.3 The *Contractor* shall arrange, where reasonably possible, for the temporary removal and reinstatement of suspended ceilings, vitreous enamel panels, floor trays, access covers and other such items to facilitate access to all equipment.

01.25.4 Furniture, suspended ceilings, tiles, raised floor trays, vitreous enamel panels and other such items temporarily removed for access shall be reinstated at the end of the shift. Any dust and dirt arising removed by vacuum cleaner (battery operated or 110 volt with a current PAT label) and the Site left clean and tidy. Suspended ceiling tiles, raised access floor trays, vitreous enamel panels and the like temporarily removed for access shall be referenced to ensure correct position and orientation upon reinstatement by the *Contractor*. In the event that the *Contractor* (having used its best endeavours) is unable to reinstate any items, it shall before leaving site place the items which have not been reinstated in a safe location, make the area safe and secure and report the matter to the Station Supervisor and the

Project Manager. The *Project Manager* will arrange for others to complete the reinstatement works where it is agreed that the *Contractor* has acted reasonably.

- 01.25.5 Suspended ceiling tiles, raised access floor trays, vitreous enamel panels and the like removed for access shall be cleaned to ensure no dirty marks, finger prints or other such blemishes are apparent upon reinstatement.

01.26 Miscellaneous

- 01.26.1 Where the *Contractor* undertakes work or makes deliveries to the *site* which impacts on public or private highways, including access to the *site* and to other premises/establishments, the *Contractor* shall supply, erect, maintain and remove prior to Completion, such traffic signs and barriers as may be necessary by the Code of Practice for New Road and Street Works (1997) to guide and warn traffic and to protect pedestrians and to prevent danger thereto.

Appendix 01.1

Not Used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 02

Constraints on the Method, Order and Timing of the Works

Table of Contents

02.1	Introduction	1
02.2	Glossary	1
02.3	Activities Undertaken by the <i>Employer</i>	2
02.4	Interoperable Railway Sections and Legacy Train Systems	2
02.5	Space Allocation – OPO CCTV Equipment	3
02.6	Space Allocation – OTC – Infrastructure Borne Equipment	3
02.7	Space Allocation – Stopping Markers	3
02.8	Station Equipment Rooms	4
02.9	Statutory Undertakers and Utilities	4
02.10	Asbestos	4
02.11	Avoidance of Clashes with the Existing Assets	5
02.12	General Constraints	5
02.13	Storage	6
02.14	Under Track Crossings	6
02.15	Bracketry and Fixings to LU Assets	6
	Appendix 02.1 – Loading Restrictions on Structures	7

02.1 Introduction

02.1.1 This Common Works Information 02 (CWI 02) describes the constraints on the method, order and timing of the *works* which the *Contractor* shall comply with. The objective is to provide a framework to the *Contractor* to development its designs, strategies and plans to comply with the Works Information and to limit disruption to the operational railway.

02.2 Glossary

The following terms apply to this CWI 02.

Term	Definition
Cable Route Management System (CRMS)	physical containment, routing and protection systems for cables, including, where required, to segregate different types of cables for any or all safety, maintenance or electromagnetic compatibility reasons.
RVAR Humps	changes to platform height to match sill height of train at locations of the designated train doors in compliance with Railway Vehicle Accessibility Regulations (RVAR).
Platform Datum Pin	Platform Datum Pins are physical markers installed by the <i>Employer</i> on each of the platforms for the purpose of enabling the <i>Contractor</i> to utilise these datum points for determining the position of OPO CCTV Cameras, OTC – Infrastructure Borne Equipment RFID tags, Stopping Markers, etc.
Platform Stopping Markers	Platform Stopping Markers consist of rectangular plates bearing a series of chevron markings to facilitate a train operator stopping at the Platform Stopping Position.
Platform Stopping Position (PSP)	The Platform Stopping Position is the designated nominal stopping position for the new train and is used as the datum to determine the position of the train for design, installation, testing and commissioning of the OPO CCTV System. PSPs for each platform will be shown on drawings issued as part of the Works Information. The Platform Stopping Position is referenced from a datum point at the Platform Datum Pin at the leading end of the train in the direction of departure for a normal move. Dimensions on the drawings are +ve in the direction of travel of the train for a normal move; dimensions to features in the platform are therefore generally shown as -ve on the CAD drawings. Dimensions are taken along the centreline of the track, taken perpendicular from the track centreline.
Safe Systems of Work	detailed arrangements and instructions to ensure that work is completed safely based on hazard identification and the associated risk assessment processes.
Asbestos Control Unit	Asbestos Control Unit (ACU) is the LUL team that provides expert help for managing asbestos.
TfL Asbestos	asbestos register that is maintained by the TfL Group in

Register	accordance with Regulation 4 of the Control of Asbestos Regulations 2012. It is the repository of asbestos information for all premises and track locations on the LUL Network.
Application for Space	process which determines how space shall be allocated to parties requiring space on operational property.

02.3 Activities Undertaken by the *Employer*

- 02.3.1 The *Employer* provided approved applications for an allocation of space for OPO CCTV System equipment racks – this information is in SWI 02 Constraints on the method, order and timing of the works. For the avoidance of doubt, these approved applications for an allocation of space do not include space for cables and containment outside of the equipment racks.
- 02.3.2 The *Employer* will provide approved applications for an allocation of space for OTC – Infrastructure Borne Equipment racks to the *Contractor* after the Order Commencement Date. For the avoidance of doubt, these approved applications for an allocation of space will not include space for cables and containment outside of the equipment racks.
- 02.3.3 The *Employer* undertakes refurbishment of all the station equipment rooms where the *Employer* has secured approved applications for an allocation of space. The refurbishment will include power connections for OPO CCTV System and OTC – Infrastructure Borne Equipment that will consist of separate dedicated feeds from a local distribution board that are terminated with a switch disconnectors that are not more than 2m from the rack location defined in the approved Applications for Space.
- 02.3.4 The *Employer* provides Platform Datum Pins for setting on equipment on platforms.
- 02.3.5 The *Employer* will provide CAD drawings that will include information about Platform Stopping Positions and the location of the Platform Datum Pin after the Order Commencement Date.
- 02.3.6 The *Employer* will procure design, manufacture and deliver the Platform Stopping Markers to the *Contractor*.
- 02.3.7 The *Employer* is responsible for obtaining consents related to heritage.

02.4 Interoperable Railway Sections and Legacy Train Systems

- 02.4.1 The *Contractor* shall design and install the OPO CCTV System to operate completely independently and without any interference to and from the systems used for operating other type of trains on the interoperable railway sections as defined in the SWI 02 Constraints on the method, order and timing of the works.
- 02.4.2 The *Contractor* shall design and install the OPO CCTV System to operate completely independently and without any interference to and from the legacy train systems while the legacy trains are still in passenger service.

02.5 Space Allocation – OPO CCTV Equipment

- 02.5.1 Where space is required for the installation of OPO CCTV System (e.g. cables, trunking, bracketry, cameras, etc.) on LUL operational property, the *Contractor* is responsible for administering the space allocation process, as defined by TfL Standard S1472 Allocation of Space on Operational Property.
- 02.5.2 The *Contractor* identifies an area and size of space required and surveys the station or track for suitable space.
- 02.5.3 The *Contractor* prepares all drawings and completes the Applications for Space.
- 02.5.4 The *Employer* is responsible for the final approval of the Application for Space and the *Contractor* allows sufficient time for the review and acceptance of the applications.

02.6 Space Allocation – OTC – Infrastructure Borne Equipment

- 02.6.1 In accordance with Schedule 9 of the Implementation Works Terms – Systems Engineering, Integration and Interface Schedule, the *Contractor* shall agree with the Lead PDP the locations for the installation of the OTC – Infrastructure Borne Equipment RFID tags and antennae.
- 02.6.2 Where space is required for the installation of OTC – Infrastructure Borne Equipment (e.g. cables, trunking, bracketry, antennae, receivers) on LUL operational property, the *Contractor* is responsible for administering the space allocation process, as defined by TfL Standard S1472 Allocation of Space on Operational Property.
- 02.6.3 On the basis of the agreed Interface Control Document (ICD), the *Contractor* identifies an area and size of space required and surveys the station or track for suitable space.
- 02.6.4 The *Contractor* prepares all drawings and completes the Applications for Space.
- 02.6.5 The *Employer* is responsible for the final approval of the Application for Space and the *Contractor* allows sufficient time for the review and acceptance of the applications.

02.7 Space Allocation – Stopping Markers

- 02.7.1 In accordance with Schedule 9 of the Implementation Works Terms – Systems Engineering, Integration and Interface Schedule, the *Contractor* shall agree with the Lead PDP the locations for the installation of the Stopping Markers.
- 02.7.2 Where space is required for the installation of Stopping Markers by the *Contractor* on LUL operational property, the *Contractor* is responsible for administering the space allocation process, as defined by TfL Standard S1472 Allocation of Space on Operational Property.
- 02.7.3 On the basis of the agreed ICD, the *Contractor* identifies an area and size of space required and surveys the station or track for suitable space.
- 02.7.4 The *Contractor* prepares all drawings and completes Applications for Space.

02.7.5 The *Employer* is responsible for the final approval of the Application for Space and the *Contractor* allows sufficient time for the review and acceptance of the applications.

02.8 Station Equipment Rooms

02.8.1 The *Contractor* shall comply with all requirements and constraints set in the Works Information when working in the stations.

02.8.2 The *Contractor* shall identify in its Programme the date(s) by when it requires access to the station equipment rooms in relation to the OPO CCTV System installation works.

02.8.3 The *Contractor* shall ensure that Safe Systems of Work are employed when working in operational equipment rooms and live assets shall be protected from interference caused by the *works* to ensure no impact to the operational railway. Where space is constrained and suitable Safe Systems of Work cannot be implemented it may only be possible to work in operational equipment rooms when there is no operational service running, such as during Engineering Hours or Closures.

02.8.4 The *Contractor* shall submit to the *Project Manager* for review any proposed modifications that require the *Employer* to change locations of equipment rack(s).

02.9 Statutory Undertakers and Utilities

02.9.1 The *Contractor* is responsible for determining the requirements of statutory undertakers and shall comply with the same.

02.9.2 The *Contractor* is responsible for the protection of existing utilities on or adjacent to the *site* while providing the Works. Should the *Contractor* become aware of any damage to any utilities during the *works*, the *Contractor* must notify the *Project Manager* as soon as it becomes aware of the matter.

02.9.3 Should the *Contractor* require existing utilities to be enabled, disabled or relocated, then it is the *Contractor's* responsibility to make any necessary arrangements directly with the utility provider and to notify the *Project Manager*.

02.10 Asbestos

02.10.1 The *Contractor* shall plan and design the *works* to avoid disturbing any known asbestos identified in the reports extracted from the TfL Asbestos Register and provided in Site Information.

02.10.2 The *Contractor* shall be responsible for reviewing the latest TfL Asbestos Register information that can be found on the TfL Asbestos Register SharePoint site: <https://sharelondon.tfl.gov.uk/ru/hmps/Pages/Home-page.aspx>

02.10.3 If any changes are identified between the TfL Asbestos Register SharePoint site and the TfL Asbestos Register reports provided in Site Information, the *Contractor* shall inform the *Project Manager* immediately.

- 02.10.4 If the *Contractor* discovers asbestos that is not on the TfL Asbestos Register, the *Contractor* shall inform the *Project Manager* immediately.
- 02.10.5 The *Contractor* shall plan, set up and manage a Safe System of Work to deal with known asbestos hazards and risks from unknown asbestos.
- 02.10.6 Prior to any works being undertaken the *Contractor* shall confirm the presence or absence of any asbestos and the status and condition of the proposed work locations with the *Project Manager*.
- 02.10.7 If the *Contractor* comes across asbestos that appears to be damaged, the *Contractor* shall suspend work in the immediate area and inform the *Project Manager*.
- 02.10.8 The *Contractor* shall comply with all relevant requirements of TfL Standard S1130 Control of Asbestos in London Underground Premises and shall review and adequately implement the relevant guidelines of the TfL Guidance Document G0130 Asbestos Control & Management.

02.11 Avoidance of Clashes with the Existing Assets

- 02.11.1 Where following a site survey or inspection the *Contractor's* design proposes that a component of the OPO CCTV System is to be installed at a trackside or station location where there is an existing physical constraint preventing its installation, then the *Contractor* shall immediately notify the *Project Manager*. A joint review will be held between the *Project Manager* and the *Contractor* to assess the following:
- a) the *Contractor's* approach to its design; and
 - b) the *Contractor's* proposed re-design and/or relocation.
- 02.11.2 The *Contractor* does not have exclusive use of the *site*. The *Contractor* shall liaise with the *Project Manager*, Others and endeavour to mitigate impacts on the *works*.

02.12 General Constraints

- 02.12.1 If the use of a lift, escalator or moving walkway to move tools and equipment is required the *Contractor* shall obtain a valid movement of materials licence as set out in TfL Guidance Document G1233 Movement of materials in lifts and escalators.
- 02.12.2 When planning movement of materials within stations, the *Contractor* shall consider the load restrictions as listed in the Appendix 02.1.
- 02.12.3 The *Contractor* shall comply with cutting, grinding, drilling, fixing to, or supporting from existing structural members that are part of LU assets as set out in TfL Standard S1063 Cutting, grinding, drilling, fixing to and supporting from existing structures.
- 02.12.4 The *Contractor* shall comply with gauging and clearance approval for any temporary or permanent asset, structure or equipment to be installed, modified or adjusted that is located less than 5m above or within 3m laterally of LU track as set out in TfL Standard S1156 Gauging and Clearances.

02.12.5 Where the *Contractor's* design requires installation of equipment that may disturb track ballast, the *Contractor* shall undertake any necessary surveys to determine if any hazardous contaminants are present before undertaking the works.

02.13 Storage

02.13.1 The *Employer* has made no explicit provision for storage of any materials, plant and equipment on the *site*.

02.13.2 If storage in the station is required, the *Contractor* shall follow the process for applying for a storage licence is described in Leaflet 14 – Applying for a storage licence.

02.13.3 The *Contractor* shall maintain records of all materials; plant and equipment stored on the *site*; these records shall be made available to the *Project Manager* upon request.

02.14 Under Track Crossings

02.14.1 The *Contractor* shall design the works to avoid or minimise undertrack crossing cable routes.

02.14.2 Where it is demonstrably not feasible to use alternative cable routes, the *Contractor* shall design and install undertrack crossings using unburied flexible ducts.

02.15 Bracketry and Fixings to LU Assets

02.15.1 The *Contractor* shall design equipment bracketry and fixings to station and trackside infrastructure which include cast iron tunnel rings in the tunnel section.

02.15.2 The *Contractor* shall design equipment posts, bracketry and fixings to station infrastructure and trackside infrastructure which include platforms without canopies in the open section.

Appendix 02.1 – Loading Restrictions on Structures

See separate document titled “Appendix_02.1_Loading_Restrictions_on_Structures”

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 03

Access

Refer to the General Terms, Schedule 14 – Access

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 04

Interfaces

Refer to the Implementation Work Terms, Schedule 9 - System Engineering, Integration and Interface Management Schedule.

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 05

Technical Requirements

Table of Contents

05.1	General	1
05.2	Glossary	1
05.3	Technical Requirements	3
05.3.1	System Level Requirements	3
05.3.2	Image Capture (Coverage of the Platform)	8
05.3.3	Station Installation	19
05.3.4	Train Borne Equipment	21
05.3.5	Reliability Availability Maintainability and Safety (RAMS)	28
05.3.6	Human Factors	30
05.3.7	Testing and Commissioning	31
Appendix 05.1 - Camera Overlap Diagram		37
Appendix 05.2 - Image Presentation Layout		38
Appendix 05.3 - Overlap Marker		44
Appendix 05.4 - Rolling Stock Performance Data		45
Appendix 05.5 - Extracts From The Rolling Stock Technical Requirements Specification		47
Appendix 05.6 – Camera label		51

05.1 General

- 05.1.1 This CWI 05 sets out the Technical Requirements for the OPO CCTV System.
- 05.1.2 The requirements specified in Section 05.3.3 – Station Installation are also applicable to the installation of the Off Train Communications (OTC) - Infrastructure Borne Equipment as specified in paragraph 01.9.2.5 of CWI 01 Description of the Works.
- 05.1.3 The unique reference number from the *Employer's* IBM Rational DOORS requirements database is provided for every technical requirement, heading and informative text. The *Employer's* DOORS number is shown in blue at the right hand side of the page.
- 05.1.4 The *Contractor* shall use the *Employer's* DOORS number in all Technical Information.
- 05.1.5 Informative text/guidance notes are shown in italics and apply to the relevant requirement and have no other meaning in other parts of the Works Information or Contract.

05.2 Glossary

- 05.2.1 The terms and phrases defined in the below table apply to all elements of this CWI 05.

Term	Definition
Assurance	Means the provision of evidence given to the <i>Employer</i> for each Assurance Stage to demonstrate that the requirements defined in this Contract are being and have been fully realised and Acceptance granted by the <i>Project Manager</i> all in accordance with the procedure described in CWI 06 Engineering Management and "Assure" and "Assured" shall be construed accordingly.
Baton	The Baton used by LU station staff to indicate to the Train Operator that it is time for the trains departure.
Critical Area of the PTI Corridor	Critical Area of the PTI Corridor - The Critical Area of the PTI includes the white line, any gap between the platform and the train and 590 millimetres of the train measured at platform level (to ensure that the tops of the doors are visible). Therefore, its width will vary depending on the curvature of the platform.
Deep Tube Upgrade Programme (DTUP)	A co-ordinated series of line upgrades for the Piccadilly, Central, Bakerloo and Waterloo & City lines of the London Underground network.
Interface Control Document (ICD)	The document created in accordance to Schedule 9 Implementation Works Terms – Systems Engineering, Integration and Interface Schedule to describe the interaction between two technical elements of the DTUP, to be delivered by two PDPs.
LUL Design Governance Board	The <i>Employer's</i> internal design governance structure that will review and endorse overall installation principles and design approach for installation for customer facing elements of the OPO CCTV System.
LUL Network Integration Testing	LUL Network Integration Testing is undertaken to demonstrate compatibility of the new train with both existing and newly installed systems. LUL Network Integration Testing will be undertaken during Engineering Hours.

OCC	The control room used for controlling DTUP line(s).
OCS	a system provided as part of DTUP that provides control of non-signalling assets from the Operational Control Centre.
OPO CCTV System	OPO CCTV is a system specifically designed and used for the capture of near real time images of the Platform Train Interface for display in the train cab, in order that the train operator can mitigate As Low As Reasonably Practical (ALARP), the risks for safe departure of the train from the platform in all driving modes, in any direction.
OTC - Infrastructure Borne Equipment	is the Off Train Communications System (OTC) System equipment that is mounted on the infrastructure. The OTC – Infrastructure Borne Equipment is designed and free issued by the Rolling Stock Manufacture. The OTC System provides the following functionality: a) Correct Side Door Enable (CSDE) functionality ensuring that the train doors can only be opened on the side adjacent to the platform and when the train is stopped within a defined tolerance of the Platform Stopping Position; and b) Two-way communications link to allow the transfer of data/commands to and from the train while berthed at the platform.
Platform Datum Pin	A datum pin provided on every platform by the <i>Employer</i> to facilitate setting out of the works.
Platform End Barriers	Means the barriers placed at the end of most platforms at the limit of the public area to prevent customers accessing the area beyond.
Platform Skip	means a single train or all trains not stopping at a specified platform. This could be for a planned timetabled train movement or for an emergency incident.
Platform Stopping Position (PSP)	The Platform Stopping Position is the designated nominal stopping position for the New Train and is used as the datum to determine the position of the Train for design, installation, testing and commissioning of the OPO CCTV System. PSPs for each platform will be shown on drawings issued as part of the Works Information. The Platform Stopping Position is referenced from a datum point at the Platform Datum Pin at the leading end of the train in the direction of departure for a normal move. Dimensions on the drawings are +ve in the direction of travel of the train for a normal move; dimensions to features in the platform are therefore generally shown as -ve on the CAD drawings. Dimensions are taken along the centreline of the track, taken perpendicular from the track centreline.
Platform Train Interface (PTI)	The area where the platform and train interface, which is normally accessible to customers.
PTI Corridor	PTI Corridor is defined as: A corridor parallel to the train body skin, including any gap between train and platform and not less than 490 millimetres into the train profile measured at platform level to ensure that the tops of the doors are visible. The height of the PTI corridor shall be from the platform level to a height at the top of the door aperture of the rolling stock when berthed in the platform. The PTI Corridor extends the full length of the train, the distance between head wall and tail wall, or the distance between platform end barriers, whichever is the shortest distance. The PTI Corridor shall maximise the coverage of the platform within the constraints imposed by positioning of the cameras to achieving the coverage of

	the Critical Area of the PTI on crowded platforms
Rotakin®	<p>A test target panel simulating the silhouette of a man. The target area is a flat board 1.6 metres in overall length, 0.4 metres wide and matt black in colour. Each end of the panel is shaped to represent the outline of a human head. The target panel bears high contrast resolution bars and a resolution “wedge chart”. The markings on the Rotakin target indicate resolution in TV lines per picture height when the target fills the vertical picture, defined as 100% condition (100%R).</p> 
Service Affecting Failures	<p>Means the occurrence of a technical failure in relation to OPO CCTV System, which causes (in whole or in part):</p> <p>(a) a delay to that train or any other train of 120 seconds or more; or</p> <p>(b) premature withdrawal of that Train or any other train from passenger service.</p>
Technical Information	<p>Technical Information means information and materials required by the <i>Employer</i> in order to operate the OPO CCTV System and the installation of OTC Infrastructure Equipment and Stopping Markers and shall include:</p> <p>(a) all calculations, analyses, information and interface information, drawings, records (including design, manufacture, installation, test, commissioning, maintenance and operational records) and data and Documentation;</p> <p>(b) all safety cases, assurance information, approvals (including restrictions on use), hazard and safety risk logs, verification and validation records;</p> <p>(c) the operating and maintenance manuals; and</p> <p>(d) all training materials.</p>
Terminal Platforms	Means a single ended platform where trains terminate and depart in the opposite direction to their arrival.
Train Operator	The LUL term used for the person in charge of an individual train.

05.3 Technical Requirements

05.3.1 System Level Requirements

OPO-1

05.3.1.1 Functional Requirements

OPO-2

Platform Train Interface (PTI) is LUL's top safety risk due to lack of physical separation between the passengers on the platforms and moving trains. The primary mitigation of the PTI risk during train dispatch is provision of a clear and uninterrupted view of the complete critical area of the PTI to the Train Operator via the OPO CCTV System.

OPO-3

The system must allow monitoring of the Critical Area of the PTI even on crowded platforms. It is accepted that customers standing between the

OPO-4

yellow line and the platform edge will obscure the view of the PTI.

Detailed requirements have been developed for the operational and technical requirements for a consistent configuration of CCTV image capture, logical presentation and system performance in order to mitigate the risk at the PTI using only CCTV equipment. OPO-5

The OPO CCTV System has to be able to provide the images in the correct format to the Train Operator for any combination of the following station platform arrangements: OPO-6

- a) *Island platforms with tracks running on both sides of the platform;*
- b) *platforms with one or two track(s) running in between two opposite facing platforms;*
- c) *platforms with alternative routes on the approach and departure sides;*
- d) *platforms used by trains running in either direction;*
- e) *platforms where trains terminate and reverse; and*
- f) *platforms where trains reverse.*

It is essential that the Train Operator only receives the correct images from each platform.

The OPO CCTV System must provide continuous, stable images to the Train Operator at all times without any sign of break-up, freezing, chrominance shift or any other impairment. The images must be displayed just prior to the train stopping at the platform, during the platform dwell time and as the train accelerates out of the platform until the rear of the train leaves the end of the platform. This requires transmission of the images to trains moving at up to 56 kilometres per hour (15.5m/s). OPO-7

It is essential that the OPO CCTV System provides images to the Train Operator in as near as real time as practicable. As the provision of the train borne cabling and display screen(s) are the responsibility of the Rolling Stock, a specific requirement has been placed on the supplier specifying that the maximum latency between the output of the OPO CCTV receiver at the front of the Train, and the presentation of the OPO CCTV images on the display screens, shall be less than 15 milliseconds. OPO-8

The Contractor is responsible for the overall systems design to ensure that the system provides near real time images to the Train Operator. OPO-9

The OPO CCTV System shall be available 24 hours, 7 days of the week. OPO-10

All elements of the station based OPO CCTV System (image capture, image processing, encoding and the station based parts of the transmission system) shall automatically restart following restoration or reconnection of power supplies. OPO-11

The OPO CCTV System shall provide continuous, stable images to the Train Operator at all times without any sign of break-up, freezing, chrominance shift or any other impairment. OPO-12

The DTUP passenger train departing from a platform can reach up to 56 kilometres per hour as the rear of the train leaves the platform. Appendix 4 provides the following data: OPO-13

- a) *The maximum run-in (braking) profile of a train entering a platform; and*
- b) *The maximum run-out (acceleration) profile of a train departing the platform.*

The commissioned system picture quality shall be graded in accordance with the Home Office Centre for Applied Science and Technology (CAST) method for assessing CCTV target images. OPO-14

The end to end system picture quality grading score shall be 6. OPO-15

The latency of the OPO CCTV System from the lenses of the platform mounted cameras to the output of the processed images (for display on screen(s) located in the cab of train) from the receiver at the front of the DTUP passenger train shall not exceed 185 milliseconds. OPO-16

The OPO CCTV System shall have a minimum refresh rate of 25 images per second or preferably 30 images per second, to reduce the buffer delay for each frame. OPO-17

The overall limiting resolution of the system for progressive scanning shall not be less than the equivalent to 504 TVL or 720P (720 x 1280 pixels) with 720 pixels per picture height from the image capture to the image display. OPO-18

The video performance for a digital system shall meet the requirements of CWI 05 Technical Requirements clause OPO-12. OPO-19

Should any fault condition such that a loss of picture or freezing occurs at the stop position or during the first 70 metres run out where the video picture is disturbed below grade 3 or less, the picture shall be removed from the display and an error message displayed. OPO-21

Inputs from train borne systems may be used for antenna selection, control of video display blanking relative to train position, radio frequency channel selection and other OPO CCTV functions specified in this Technical Requirements Specification. OPO-22

Technology is provided by the Rolling Stock Manufacturer to ensure that the doors shall be enabled only when the DTUP passenger train has stopped at any point within a zone which is 2.0 metres in length and which is centred on the Platform Stopping Position, such that the stopping window extends from a point 1.0 metres short of the Platform Stopping Position to a point 1.0 metres forward of the Platform Stopping Position. OPO-23

OPO images are required to be displayed to the Train Operator: OPO-24

- a) *in the active cab as the DTUP passenger train comes to a rest (except at terminal stations). Window of operation to allow for full stopping tolerance;*
- b) *in active cab at all times when the DTUP passenger train is stationary in the platform, noting that the active cab may change for trains that are reversing in the platform; and*

- c) *in active cab from the time that the operator initiates departure at a platform until the rear of the train has left the PTI Corridor.*

For information, the train length for the Piccadilly and Bakerloo lines has been specified as 113 metres; a stopping tolerance of +/-1.0 metres is allowed on the Platform Stopping Position.

OPO CCTV Images shall be displayed to the Train Operator: OPO-25

- a) whilst the DTUP passenger train is stationary at the Platform Stopping Position;
- b) immediately prior to the DTUP passenger train coming to a stand at the Platform Stopping Position i.e. within the window of the normal stopping position; and
- c) during the platform departure, until the train has cleared the platform.

OPO CCTV images shall be displayed to the Train Operator commencing from a point -1.0 metre (minus 1.0 metre) from the Platform Stopping Position. A unilateral tolerance of -5 metres (minus 5 metres) shall be permitted on this requirement. OPO-26

OPO CCTV Images shall be displayed to the Train Operator until the rear of the train has departed from the PTI Corridor (With the exception of Platform Skip). OPO-27

OPO CCTV Images shall be displayed to the Train Operator continuously between the locations specified in requirements OPO-26 and OPO-27 at all train speeds (With the exception of Platform Skip). OPO-28

OPO CCTV Images shall not be displayed to the Train Operator at speeds above the threshold of 10 kilometres per hour for Platform Skip. OPO-29

At Terminal Platforms OPO CCTV Images shall not be displayed to the Train Operator in the leading cab as the DTUP passenger train arrives into the platform. OPO-30

At Terminal Platforms OPO CCTV Images shall be displayed to the Train Operator when the cab at the departure end (leading end in the direction of travel away from the platform) becomes the active cab. OPO-31

At Terminal Platforms OPO CCTV Images shall be displayed to the Train Operator in the leading end cab at the departure end from the time that the train is ready to depart (when it will be berthed within the Platform Stopping Position window) until a point 114.0 metres (plus 114.0 metres) from the Platform Stopping Position. This allows for the stopping tolerance in the platform. OPO-32

(The datum point is the Platform Datum Pin at the leading end for a departing train with dimensions measured in the direction of travel, so at Cockfosters (for example) the Platform Stopping Position is -112.0 metres. Departing cab will therefore be at +1.0 metres ±1.0 metres).

OPO CCTV images shall be displayed to the Train Operator departing from a terminal platform until the rear of the DTUP passenger train has departed from the PTI Corridor. OPO-33

At Terminal Platforms OPO CCTV images shall be displayed to the Train Operator continuously between the locations specified in requirements OPO-34

OPO-32 and OPO-33.

At platforms with reversing moves OPO CCTV images relating to the reversing move shall be displayed to the Train Operator when the cab at the departure end becomes active. OPO-35

At platforms with reversing moves OPO CCTV Images relating to the reversing move shall be displayed to the Train Operator until the rear of the DTUP passenger train has departed from the PTI Corridor. OPO-36

At platforms with reversing moves the OPO CCTV images shall be displayed to the Train Operator continuously between the locations specified in requirements OPO-35 and OPO-36. OPO-37

All elements of the OPO CCTV System shall compensate for the full range of variations in ambient lighting conditions including the emergency lighting level needed to cope with degraded modes of operation of the railway. This shall include consideration of glare at all angles of the sun. OPO-38

TfL Standard S1066 Lighting of London Underground Assets contains details of expected lighting levels on platforms. OPO-39

The OPO CCTV system shall comply with EMC Directive 2014/30/EU; if the system includes an intentional transmitter, then compliance with Radio Equipment Directive 2014/53/EU is required.. OPO-40

The OPO CCTV System performance requirements shall be met for the full range of installation / operating environments likely to be encountered by the OPO CCTV System. This shall include all parameter ranges and tolerances defined in BS EN 50125-3 Railway applications - Environmental conditions for equipment. OPO-41

05.3.1.2 Transmission System OPO-42

A transmission system shall be provided to transfer the processed captured platform images to the DTUP passenger train for display in the active cab. OPO-43

A radiating/ close coupled inductive system (leaky feeder) shall be employed. OPO-44

The *Contractor* shall select the radio, protocol and frequency for the track to train CCTV transmission, the frequency range from 30 to 950MHz shall be targeted. OPO-45

The *Contractor* shall obtain and transfer to the *Employer* any licences necessary for the radio frequencies chosen. OPO-46

The *Contractor* shall submit for acceptance by the *Employer* written justification for selecting the proposed radio frequency, to include all mitigation techniques to be used against potential interferences from external sources. OPO-47

The transmission system employed shall have sufficient bandwidth: OPO-48

- a) to provide adequate video streams to ensure that the correct image is always transmitted to the correct train; and
- b) to prevent cross interference of platform images particularly from

opposing platforms.

The video channels shall be controlled such that the correct image and format is always presented to the Train Operator on the correct screen at all times, at the correct time and position. OPO-49

The transmission system shall provide the coverage required for all train movements from the PTI in all running modes, for normal movements, reversing and termini platforms. OPO-50

Where multiple transmission elements are utilised the transition from one device to the next shall provide a seamless video stream, i.e. no visible disruption to the displayed image. OPO-51

Any switching of images shall be seamless to the Train Operator. OPO-52

The video channels shall be controlled such that the correct image and format is always presented to the Train Operator on the appropriate screen at all times, for normal and reversing platforms. OPO-53

The system shall also provide frequency channel agility such that different rolling stock fleets can utilise the same transmission infrastructure with the same or if necessary differing camera configuration. OPO-54

05.3.2 Image Capture (Coverage of the Platform) OPO-55

The area to be covered by the OPO CCTV System is defined as the PTI Corridor. This includes the edge of the train (to provide visibility of the door portals), the gap between the train and platform, and the edge of the platform including the nosing stone and tactile strip. OPO-56

PTI Corridor is defined as: A corridor parallel to the train body skin, including any gap between train and platform and not less than 590 millimetres into the train profile measured at platform level to ensure that the tops of the doors are visible. The height of the PTI corridor shall be from the platform level to a height at the top of the door aperture of the rolling stock when berthed in the platform. The PTI Corridor extends the full length of the train, the distance between head wall and tail wall, or the distance between platform end barriers, whichever is the shortest distance. The PTI Corridor shall maximise the coverage of the platform within the constraints imposed by positioning of the cameras to achieving the coverage of the Critical Area of the PTI Corridor on crowded platforms. OPO-57

The limits of the PTI Corridor at both ends of the platform will be defined on the drawings provided by the Employer. OPO-58

The Critical Area of the PTI includes the white line, any gap between the platform and the train and not less than 590 millimetres of the train measured at platform level (to ensure that the tops of the doors are visible). Therefore, its width will vary depending on the curvature of the platform. OPO-59

Coverage of the PTI Corridor, and the Critical Area of the PTI, must be 100% without blind spots while meeting the requirements for image quality and size of a Captured Target (2 year old 5th percentile female child). This shall be achieved by the use of a minimum of 2 and a maximum of 8 cameras. The views from adjacent cameras are required to overlap; alignment marks are painted on the platform at the locations of the OPO-60

overlaps to demonstrate that this is achieved.

The OPO CCTV System must allow monitoring of the critical area of the PTI even on a crowded platform. It is accepted that customers standing between the yellow line and the platform edge will obscure the view of the PTI. OPO-61

05.3.2.1 Preliminary Surveys

OPO-62

Drawings providing the essential survey data and key constraints are provided for every Piccadilly Line platform. Bakerloo Line surveys will be provided when the Option is exercised. These are provided as Microstation CAD file in DGN format. The drawings provide the following: OPO-63

The alignment of the running rails, track centre line and platform edge, based on site surveys at 5 metres centres (2.5 metres where the track radius is less than 200 metres);

- a) *The Platform Stopping Position;*
- b) *The limits of the PTI Corridor at both ends of the platform;*
- c) *The DTUP passenger train stopped at the Platform Stopping Position;*
- d) *The DTUP passenger train stopped at -1 metre (minus 1 metre) from the Platform Stopping Position;*
- e) *The DTUP passenger train stopped at +1 metre (plus 1 metre) from the Platform Stopping Position;*
- f) *Details of existing Platform End Barriers and existing monitors/mirrors;*
- g) *Details of planned changes/removals to Platform End Barriers including staging details where appropriate;*
- h) *Details of planned removals of MDA's; and*
- i) *Location of Platform Datum Pins*

A preliminary survey (non intrusive) shall be undertaken for every platform to determine the characteristics and constraints to support the design process. OPO-64

As a minimum the Preliminary Survey shall identify the following: OPO-65

- a) *platform signage;*
- b) *locations of any existing cameras;*
- c) *obstructions;*
- d) *sunlight;*
- e) *sunlight reflections;*
- f) *type of platform lighting;*
- g) *differential lighting along the platform (i.e. under and beyond canopies);*
- h) *all other environmental conditions; and*
- i) *locations of other equipment that may affect camera locations and views e.g. dot matrix indicators.*

- 05.3.2.2 Conceptual Design (Image Capture)** OPO-66
- The conceptual design for platform imaging systems is divided into two phases. The first of these is a desk top study to determine the minimum number of cameras, the specification for each lens assembly and their locations to achieve coverage of the PTI taking cognisance of the results of the Preliminary Survey. This desk top study includes an assessment of the effects of sunlight and reflection's and the evaluation of appropriate mitigations. The second phase is the validation of the theoretical coverage and line of site using cameras mounted on tripods to simulate the intended installation. A Rotakin is used to determine that the target percent image height is achieved at the far points and indeed throughout the range. Temporary platform markings are used to ensure that the overlap requirements are achieved.* OPO-67
- A Conceptual Design for the Imaging System shall be prepared for each platform. OPO-68
- The Conceptual Design for the Image System for each platform shall consider the DTUP passenger train berthed in the following positions in the platform: OPO-69
- a) At the Platform Stopping Position;
 - b) -1 metre (minus 1 metre) from the Platform Stopping Position; and
 - c) +1 metre (plus 1 metre) from the Platform Stopping Position.
- The Conceptual Design for the Image System for each platform shall determine the minimum number of cameras necessary to achieve 100% coverage of the PTI Corridor and the Critical Area of the PTI with the train at each of the positions defined in requirement OPO-69 without blind spots. OPO-70
- The PTI shall be covered by utilising opposing cameras nominally overlapping at the platform centre, facing the head wall and tail wall respectively. OPO-71
- A minimum of two (2) and a maximum of eight (8) cameras shall be used, in groups of two (2), four (4), six (6) or eight (8) as illustrated in Appendix 05.1. OPO-72
- The camera grouping shall follow the format illustrated in Appendix 05.2, such that the images presented are of the same basic format for each platform in order to satisfy consistency and Human Factors. OPO-73
- Platform alignment marks shall be in accordance with Appendix 05.3. OPO-74
- The standard camera alignment and overlap platform marking (Appendix 05.3) shall be used for all overlaps for both consecutive and opposing cameras. OPO-75
- The camera overlap alignment platform mark shall be clearly visible at the bottom of each image where the actual distance on platform of the centre of the mark is a minimum of 500 millimetres from the point of incidence of lower elevation of camera view. OPO-76
- 05.3.2.2.1 Camera Assembly Performance** OPO-77

The lens fitted to the camera shall not significantly reduce the overall optical performance of the system in terms of limiting resolution, Modulation Transfer Function or introduce aberrations or distortions significant to the operator tasks. OPO-78

The optical systems, including lens and camera housing faceplate, shall be optimised for maximum depth of focus between the near and far points, ensuring that the system resolution and Modulation Transfer Function is uniform throughout the field of view and that they do not fall below that required over the length of the PTI. OPO-79

Only fixed and zoom lenses shall be used, the use of vary-focal lenses are unacceptable unless evidence can be provided that the optical performance complies with requirements OPO-78 and OPO-79. OPO-80

In all cases the lens magnification of each camera shall be closely matched on each platform in order to provide a consistent image size and field of view, when two or more images are added together via the video splitter/combiner. OPO-81

05.3.2.2.2 Camera Location, Coverage and Target Size OPO-82

The cameras shall be installed at a height that is sufficient to view the PTI over the heads of customers but low enough for adequate sight line of the platform length and width. OPO-83

Cameras shall be positioned nominally over the edge of the platform to ensure that the Critical Area of the PTI can be seen even on a crowded platform. OPO-84

On convex platforms the camera positions may need to be biased trackside of the platform edge to ensure the optimum view of the gap between the train and platform. Similarly, on concave platforms the cameras may need to be biased slightly inboard of the platform to achieve the same objective. OPO-85

The camera installations with reference to the platform edge and platform surface shall be compliant to TfL Standards S1156 Gauging and Clearances and S1371 Station Planning. OPO-86

The vertical alignment of all cameras shall be adjusted to achieve full visibility of the height of the PTI corridor. OPO-87

The height of the PTI corridor shall be from the platform to height of door aperture of the rolling stock when berthed in the platform or two (2) metres whichever is the greater. OPO-88

The horizontal view of the camera, on an empty platform, shall provide the following while maximising coverage of the platform: OPO-89

- a) not less than 590 millimetres of the train measured at platform level (to ensure visibility of the tops of the doors); and
- b) any gap between train and platform.

The overall coverage of the PTI Corridor shall be 100% without any blind spots. OPO-90

The cameras shall provide a continuous view of the Critical Area of the PTI Corridor when a 1.7 metres high barrier (representing a crowded platform) OPO-91

is placed 400 millimetres behind the platform edge. As a minimum this shall include coverage of the Critical Area of the PTI Corridor:

- a) not less than 590 millimetres of the train measured at platform level (to ensure visibility of the tops of the doors);
- b) any gaps between the train and platform; and
- c) the full width of the white line (100 millimetres) on the edge of the platform where this is not hidden by the train.

To enable the OPO CCTV System to achieve the required Conspicuity (probability of Detection) of not less than 95% for a 2 year old British female (825 millimetres tall and 150 millimetres chest depth including clothing) a minimum target size must be achieved at the far point of each camera. The target size is expressed as the percentage of the captured image height that the standard Rotakin occupies when positioned at the far point of each camera (%Rotakin). OPO-92

For convenience targets are expressed as Target size %Rotakin rather Target size %Child. OPO-93

Targets captured at the far points of each camera shall not be less than: OPO-94

- a) 16.5%Rotakin for 2 (two) and 4 (four) camera layouts;
- b) 24.8%Rotakin for 6 (six) camera layouts; and
- c) 26.4%Rotakin for 8 (eight) camera layouts.

The Conceptual Design for the Image System for each platform shall include calculations and CAD drawings to determine the location for each camera lens assembly, and the specification for each camera lens assembly. OPO-95

05.3.2.2.3 Processing of Captured Images OPO-96

The Rolling Stock Manufacturer indicated an intention to use 4:3 aspect ratio for the patch of the display screens for the OPO CCTV images. This will be subject to formal agreement via the Interface Control Document in accordance with the process specified in Schedule 9 of the Implementation Work Terms. OPO-400

The camera images captured shall be cropped and added together with no more than 4 camera images per (viewing) display screen. OPO-97

All presented images for viewing shall be either a 2-way full vertical split, 3-way vertical split or 4-way vertical split (no full captured image used) as illustrated in Appendix 05.2. OPO-98

For two (2) camera configurations a single display screen shall be used. OPO-99

For two (2) camera configurations the images shall be processed as follows: OPO-100

- a) the two (2) opposing images shall be cropped 50% of picture width from the train interface left or right dependant upon the side the platform is situated; and
- b) the two (2) images shall be added together via a splitter/combiner unit and fed to the display system as a full image.

- For four (4) camera configurations two display screens shall be used. OPO-101
- For four (4) camera configurations the images shall be processed as follows: OPO-102
- a) each of the two sequential images (head and tail wall) shall be cropped at 50% picture width from the train interface left or right dependant upon the side the platform is situated; and
 - b) each of the two (2) images shall be added together via a splitter unit and fed to the correct display screen as a full image.
- For six (6) camera configurations two display screens shall be used. OPO-103
- For six (6) camera configurations the images shall be processed as follows: OPO-104
- a) each of three (3) sequential images (Head and Tail Wall) shall be cropped at 50% picture width from the train interface left or right dependant upon the side the platform is situated; and
 - b) the three (3) image patches added together, zoomed down vertically and horizontally to fit the display screen format such that three images are displayed on each display in the correct sequence.
- For eight (8) camera configurations two display screens shall be used. OPO-105
- For eight (8) camera configurations the images shall be processed as follows: OPO-106
- a) each of the four (4) sequential images (Head and Tail Wall) shall be cropped at 40% picture width from the train interface left or right dependant upon the side the platform is situated; and
 - b) the four (4) image patches added together, zoomed down vertically and horizontally to fit the display screen format such that four images are displayed on each display in the correct sequence.
- The cropped and combined images shall have a separation band of 1.5 millimetres. OPO-107
- An indication to show that the display is not used shall be provided on any unused display screen in order to avoid confusion of how many images should be present for any platform without using transmission bandwidth. OPO-108
- In all cases all Tail Wall facing camera images shall be inverted horizontally right to left. OPO-109
- The platform shall always be presented on the correct side of the display such that it can be associated with the door controls in a logical fashion, i.e. left hand platforms shall be presented on the left of the display screen for all normal and reversing moves from any platform. OPO-110
- The images shall run in sequence from Head Wall to Tail Wall left to right or right to left depending upon the platform orientation and should be scanned by the Train Operator in this order, as illustrated in Appendix 05.2. OPO-111
- The picture combiner shall electronically synchronise and combine the composite video outputs of the cameras into a single image picture of 2, 3 OPO-112

or 4 cropped processed image patches.

The picture combiner shall introduce negligible picture degradation such that there is no impact upon the operator's performance. OPO-113

The combiner display shall provide a clear edge boundary and separation to each picture along their joint vertical boundary, with no evidence of "tearing" or other visible distraction. OPO-114

The combined images shall be displayed on the screen in an appropriate position in order to minimise to ALARP the errors of viewing angles. OPO-115

No text or symbology shall obscure the image of the PTI Corridor displayed on the screen. OPO-116

05.3.2.2.4 Assessment and Mitigation of Sunlight and Reflections OPO-117

The Conceptual Design for the Image System for each above ground platform shall include an assessment of effects of sunlight and reflections throughout the calendar year. OPO-118

The assessment of the effects of sunlight shall, as a minimum, identify the altitude and azimuth of the sun at hourly intervals for 365 days of the year (366 days for leap years). OPO-119

The granularity of the assessment of altitude and azimuth data shall be increased to a minimum of 10 minute intervals where potential effects of sunlight are identified. OPO-120

The assessment of the effects of sunlight shall be for a minimum of a four (4) year period. OPO-121

The Concept Design for the Image System for each above ground platform shall include an evaluation of appropriate mitigation measures required to address the effects of sunlight and reflections identified as part of the assessment required by requirement OPO-118. OPO-122

05.3.2.2.5 Conceptual Design Report OPO-123

The Conceptual Design for each platform shall be provided as a report. OPO-124

The Conceptual Design report shall include the findings from the Preliminary Survey. OPO-125

The Conceptual Design report shall provide assurance that the findings from the Preliminary Survey have been appropriately addressed through the proposed concept design. OPO-126

Assurance may be achieved by drawings supported by representations of the captured camera views and processed images. These should include as a minimum: OPO-127

- a) *representation of the train at the full range of the stopping tolerance;*
- b) *overlap markers;*
- c) *Rotakin positioned at the near and far point for each camera; and*
- d) *demonstration of the clear views of the PTI Corridor when the*

platform is crowded (represented by a vertical barrier placed as described above).

05.3.2.3 Conceptual Design Validation (Image Capture) OPO-128

Full site surveys shall be carried out to validate the theoretical coverage and line of sight, using cameras mounted on tripods to simulate the intended installation (noting any changes to the ideal camera location on the platform that are caused by any obstructions or fixing issues). OPO-129

The Rotakin shall be used to determine that the following target image height (%Rotakin) is achieved at the far points of each camera and indeed throughout the PTI: OPO-130

- a) 16.5%Rotakin for two (2) and four (4) camera layouts;
- b) 24.8%Rotakin for six (6) camera layouts; and
- c) 26.4%Rotakin for eight (8) camera layouts.

Note: these are the same target heights specified in requirement OPO-94.

Temporary platform camera alignment and overlap markings and adjustment templates shall be used to ensure that the alignment in vertical and horizontal planes and the overlap between camera views achieves the following; OPO-131

The camera overlap alignment platform mark shall be clearly visible at the bottom of each image where the actual distance on platform of the centre of the mark is a minimum of 500 millimetres from the point of incidence of lower elevation of camera view.

Note: this is as defined in requirement OPO-76.

As the DTUP passenger train will not be available until LUL Network Integration testing phase of the programme it will be necessary to use templates / mock-ups to represent the carriages of the DTUP passenger train. These should be capable of being readily and accurately positioned relative to the track geometry to represent the train at the Platform Stopping Position and the plus and minus 1 metre positions. OPO-132

These templates will also be utilised for validating the actual installation and for commissioning the system.

Templates shall be used to represent the DTUP Rolling Stock during the validation of the imaging system design. OPO-134

As a minimum the templates shall identify door positions, the end of each carriage body shell and the specified minimum overlap. OPO-135

For platforms where 6 and 8 cameras are installed a 1.7 metre high flexible barrier (representing a crowded platform) shall be erected 400 millimetres behind the platform edge in order to verify the following minimum coverage of the Critical Area of the PTI: OPO-136

- a) not less than 590 millimetres of the train measured at platform level (to ensure visibility of the tops of the doors);
- b) any gaps between the train and platform; and
- c) the full width of the white line (100 millimetres) on the edge of the platform where this is not hidden by the train.

Note: this is the same minimum coverage as specified in requirement OPO-91.

It is permissible to achieve compliance with the above requirement OPO-136 in sections along the platform, providing such a barrier is continuous from an individual camera's position to the camera's far point. OPO-137

As a minimum the 1.7 metre flexible barrier shall be continuous from an individual camera's position to that camera's far point. OPO-138

The resolution of the camera assembly and any processing at platform level shall be measured in TV lines per picture height (TVLPPH) and mm/cycle as follows: OPO-139

- a) place Rotakin target at near point of each camera and identify that the "F" Band can be clearly seen on the display being used to measure the performance;
- b) move the target away from the camera along the PTI, target height diminishing and reference Band "F" reducing in clarity until it ceases to be clearly visible. At this position move the target back so that the point at which the band can just be clearly seen is located;
- c) measure the target height by use of an overlay template on an under scanning display (>400TVL resolution) or use a pixel count (thus removing over-scanning errors). Tabulate the results of height and relevant "F" Band mm/cycle and location relative to the platform reference Platform Datum Pin;
- d) repeat for successive mm/cycle bands to the far point for the camera; and
- e) repeat the above down the platform for each camera towards the head and tail wall respectively.

Legacy equipment may be present at the end of platform within the defined area of coverage. This may include Platform End Barriers and legacy OPO monitor assemblies and/ or mirrors. The gates of Platform End Barriers may be tied in the open position to allow line of sight to the Rotakin. OPO-140

There may be a limited number of convex platforms where legacy equipment obscures the view of the Rotakin positioned between the white and yellow line. In these circumstances it is permissible to cantilever the Rotakin from the platform providing the reference bands are within the field of view of the camera. OPO-141

Where the gate on Platform End Barriers obscures the view of the Rotakin the gate shall be secured in the open position to facilitate validation of the concept design. OPO-142

On concave platforms where legacy equipment obscures the view of the Rotakin, the Rotakin shall be cantilevered from the platform edge providing the reference bands remain within the field of view. OPO-143

Should a location be identified where it proves impossible to site the Rotakin (e.g. due to legacy equipment at the end of a platform), the Rotakin shall be placed as close to the far point position as practical and benchmark images captured in that position. In such cases calculations OPO-144

shall be provided to provide assurance that the minimum target images size will be achieved at the far point of the PTI Corridor.

Lighting surveys shall be carried out to highlight any shortfall in lux levels on any platforms where the performance of the camera assembly may not be able to provide a safe solution in order for the operator to carry out their tasks. OPO-145

The measurement of the illumination shall be carried out by placing a calibrated light meter on the platform in the centre of the PTI facing upwards towards the lighting, at least at 1000 millimetre spacing down the platform from end to end. OPO-146

A walk through test should be undertaken to verify continuity of the camera coverage. OPO-147

The walk through test shall be undertaken by an adult of approximately 1.6 metre high holding a departure Baton above head height but below the 2 metre height of the PTI Corridor. OPO-148

The walk through test shall consist of a walk of the complete length of the PTI Corridor along the nosing stones. OPO-149

A full survey report for each platform shall be compiled and submitted. OPO-150

The survey report shall include the following as a minimum: OPO-151

- a) tabulated resolution measurements for Rotakin band F down to K (depending upon camera range) together with distances from each camera in mm/cycle and TVLPPH;
- b) all camera settings such as focal length, aperture, object focus setting, where appropriate synch and burst levels and internal camera settings;
- c) the dimensions of camera position relative to the platform edge height above the platform and location from Platform Datum Pin;
- d) images shall be produced for record purposes of the images achieved and details taken of the dimensions of camera position relative to the platform edge height above the platform and location from Platform Datum Pin;
- e) the uncropped image from each camera;
- f) the uncropped image from each camera with 1.7 metre barrier behind yellow line;
- g) cropped and combined images for the platform;
- h) cropped and combined images for the platform with 1.7 metre barrier behind yellow line;
- i) a video clip of the complete walk test shall be provided on such media that replay can be achieved on an industry standard PC; and
- j) full details of the lighting surveys highlighting any shortfall in lux levels on any platforms where the performance of the camera assembly may not be able to provide a safe solution in order for the operator to carry out their tasks.

05.3.2.4 OPO CCTV Recording/Storage	OPO-152
The OPO CCTV System shall record and store all the processed and combined OPO CCTV images (as transmitted to the train) locally from each platform at all times.	OPO-153
The OPO CCTV System shall record and store all unprocessed OPO CCTV images locally from all individual OPO cameras at all times.	OPO-154
All recorded CCTV footage shall be stored locally for a minimum of two (2) weeks.	OPO-155
Recording and retrieval of OPO CCTV recordings shall provide a secure and auditable trail of evidence that satisfies the requirements of evidential continuity to prove that the data has not been tampered with in any way.	OPO-156
The video storage system shall be such that no single point failure shall result in the loss of stored video data.	OPO-157
Each CCTV image shall be recorded on two, physically separate, removable storage devices to mitigate loss of recorded images.	OPO-158
All OPO CCTV recordings shall be identified with metadata.	OPO-159
Metadata for processed and combined OPO CCTV images shall include station name, platform number, date and time.	OPO-160
Metadata for unprocessed data from individual cameras shall include the station name, platform number, camera number, date and time.	OPO-161
The date shall be displayed in accordance with the British dating convention of DD/MM/YYYY (DD/MM/YY where the length of the information field is limited).	OPO-162
The time shall be displayed in accordance with twenty four hour clock notation.	OPO-163
Time stamping of OPO CCTV images shall be accurate to +/-1 seconds.	OPO-164
Time and date information shall be derived from the Coordination Universal Time (UTC).	OPO-165
OPO CCTV recordings shall be able to be manually retrieved by a user by connecting a laptop via an Ethernet port.	OPO-166
The video storage system shall provide a comprehensive searching facility that enables review of recorded video by criteria including, but not limited to: a) Time; b) Date; c) Platform; and d) Camera number.	OPO-167
OPO CCTV recordings shall not be adversely affected by video retrieval or archiving operations.	OPO-168

- It shall be possible to extract still frames from OPO CCTV recordings. OPO-169
- Monitoring / viewings of live and recorded images shall not interfere with the continuous recording of images. OPO-170
- OPO CCTV storage media shall be manually removable. OPO-171
- OPO CCTV recordings shall be in open-standard replayable formats. OPO-172
- OPO CCTV recordings shall be viewable using codecs found in industry standard PC operating systems. OPO-173
- The OPO CCTV System shall receive a request from the OCC for live or recorded feeds to be sent to the OCC. OPO-174
- The OPO CCTV System shall respond to a valid request by transmitting the live feed of the relevant platform to the OCC. OPO-175
- The OPO CCTV System shall transmit recorded OPO CCTV images (processed or unprocessed) to the OCC upon receipt of a valid request from the OCC. OPO-176
- The OPO CCTV System shall support simultaneous transmission of both live and recorded images from the same platform. OPO-177
- The OPO CCTV System shall provide a connection port to allow connection to the T&D Data Network. OPO-178

05.3.3 Station Installation OPO-179

All materials shall comply with TfL Standard S1085 Fire Safety Performance of Materials - Stations and Tunnel Infrastructure. OPO-180

The OPO CCTV System shall be installed and commissioned to a high quality of workmanship and conform to manufacturer's installation instructions and Industry good practice including; OPO-181

- a) BS EN 50174 (Parts 1 - 3) Cabling;
- b) BS EN 62491 - Labelling of cables / cable cores;
- c) BS EN 61935 / BS EN 50346 - Cable Testing;
- d) TIA/EIA-564 series - Structured Cabling;
- e) IEC 60793-2 - Fibre Optic Cables;
- f) BS 6701 - Cable Installation/Maintenance;
- g) BS 7671 - IET Wiring Regulations;
- h) BS 7430 - COP Protective Earthing for Electrical Installations;
- i) IEEE 802.3 Wired Ethernet LAN; and
- j) IEEE 802.11 Wireless Ethernet LAN

The OPO CCTV System equipment shall be protected against electrostatic discharge and electrical surge voltages/currents that can occur in the operating environment. OPO-182

OPO CCTV System equipment shall be earthed in compliance with TfL Standard 1-106 Earthing and Bonding of LU Electrical Networks and OPO-183

- relevant standards listed in requirement OPO-181 covering protective and functional earthing.
- OPO CCTV System equipment shall be installed to ensure mechanical damage is not caused to any gaskets/ seals that will compromise IP ratings. OPO-184
- Cables shall be installed so that its armour / insulation (as applicable) is not damaged and that its bend radius is within manufacturers guidelines. OPO-185
- Cables shall be installed and tested to relevant Industry standards listed in requirement OPO-181. OPO-186
- Cable joints shall be avoided wherever possible, where this is not possible joints shall be located so it is protected from mechanical damage and it can be inspected. OPO-187
- Cable selection and layouts shall take into account of voltage drop and signal losses. Signal loss calculations shall take into account future repairs. OPO-188
- Wherever possible cables shall utilise existing cable route management systems (CRMS). OPO-189
- Where is not possible to utilise existing Cable Route Management Systems (CRMS) in public areas, the design shall minimise the visual intrusions so far as reasonably practical. OPO-190
- Where cables are installed in runs or trunking adjacent to cables of other services, all adverse effects from and to that cable / service shall be considered. OPO-191
- Wherever possible equipment installation shall not adversely impact maintainability. OPO-192
- Where practicable external surveillance and security equipment in public areas shall be installed at minimum heights from finished floor surface as required in TfL Standard S1371 Station Planning. For non-station areas, minimum height based on a local risk assessment shall be achieved. OPO-193
- System OPO CCTV System elements installed on station platforms or elsewhere close to the track shall comply with TfL Standard S1156 Gauging and Clearances. OPO-194
- Camera Installation shall comply with the following requirements; OPO-195
- a) Camera enclosures shall minimise internal reflections;
 - b) Camera enclosures in external environments shall be protected against condensation via thermostatically controlled internal heating;
 - c) Camera enclosures shall be mechanically secured against environment induced movement e.g. vibration / wind or accidental knocks; and
 - d) Mounting brackets/poles shall be protected against corrosion.
- Rack assemblies used shall conform to International Standard IEC 60297 Mechanical structures for electrical and electronic equipment. OPO-196

OPO CCTV System elements requiring mechanical protection shall where possible be installed so that it is outside the reach envelope of a 95th percentile male. OPO-197

Where system elements are exposed to external LUL environments and where there is risk of vandalism, these elements shall meet IP 65 (ingress protection) and IK10 (mechanical impact rating). OPO-198

Only cameras, necessary cabling and supporting structures shall be installed on platforms and be approved by London Undergrounds Design Governance Board. OPO-199

Processing units, picture combiners, recorders, distribution amplifiers and control elements of the OPO CCTV System shall be installed in the Communications Equipment Room (CER) specified in the Specific Works Information. OPO-200

Materials certificates shall be provided for all materials utilised in the fabrication of all bracketry. OPO-201

The design shall avoid areas with known asbestos. OPO-202

05.3.3.1 Environment OPO-203

The OPO CCTV system shall comply with BS EN 50121-4 Railway applications – Electromagnetic compatibility. OPO-204

The OPO CCTV System shall comply with the TfL Standard S1222 Electromagnetic compatibility, the guidance contained in G222 Manual of EMC Best Practice and TfL standard S1193 EMC with LU Signalling System Assets where applicable. OPO-205

05.3.4 Train Borne Equipment OPO-206

Inputs from other train borne systems can be used to control antenna selection, control of video display blanking relative to train position, RF channel selection and other OPO CCTV functions required by this specification. OPO-207

The technical requirements specification issued to the Rolling Stock Manufacturer includes specific requirements relating to the OPO CCTV System. In addition, the rolling stock technical specification includes other requirements related to the display of the OPO CCTV images within the active cab. These requirements are included for information as Appendix 05.5. OPO-208

The Contractor shall work collaboratively with the Rolling Stock Manufacturer to determine the locations on the train in which the OPO equipment will be mounted. OPO-209

The OPO CCTV System shall interface with the DTUP passenger train to utilise the touch-enabled display screens (which will be shared and subdivided as required) at the operating positions of the train to provide information to the Train Operator. OPO-210

When there is a fault in train borne OPO equipment and the effect of that fault can be mitigated by use of a redundant or backup part of the system, OPO-211

the condition of the system and the original fault shall be reported.

The OPO CCTV supplier shall provide, to the Rolling Stock Manufacturer, all necessary information and equipment relating to the OPO CCTV to Train Control Management System (TCMS) interface in order to support the construction and use of the train TCMS Simulator. OPO-212

The train TCMS simulator is a test and development tool which will be used to validate and verify the train TCMS system using real train TCMS and interfacing components.

Trainborne OPO equipment shall not be isolated due to a failure to complete an automatic test within a particular time limit, unless there is a demonstrable safety risk. OPO-213

A means of accessing service performance and fault information from all electronic control units on trainborne OPO equipment shall be provided. OPO-214

Trainborne OPO equipment shall have in-built self-test facilities. OPO-215

Trainborne OPO equipment self-test facilities shall confirm the operational status of sub-systems and equipment prior to entry into service and also on demand. OPO-216

Not Used OPO-217

All OPO equipment supplied for installation on the train shall comply with and be tested to British Standards BS EN 50121-3-2 'Railway Applications. Electromagnetic Compatibility. Rolling Stock. Apparatus' OPO-218

All OPO equipment supplied for installation on the train shall comply with and be tested to BS EN 50155 'Railway Applications. Electronic Equipment Used on Rolling Stock'. OPO-219

All OPO equipment provided for installation on the train shall comply with the requirements of British Standard BS EN 50153 'Railway applications. Rolling stock. Protective provisions relating to electrical hazards'. OPO-220

All OPO equipment supplied for installation on the train shall comply with the requirements of British Standard BS EN 50124-1 'Railway Applications. Insulation Coordination. Basic Requirements. Clearances and Creepage Distances for all Electrical and Electronic Equipment'. OPO-221

All OPO equipment supplied for installation on the train shall comply with the requirements of British Standard BS EN 50124-2 (Incorporating corrigendum May 2010) 'Railway applications. Insulation coordination. Part 2: Overvoltages and related protection'. OPO-222

All OPO electronic equipment supplied for installation on the train shall, where possible, be naturally cooled with heat sink fins located on the outside of the case. OPO-223

For each heat sink provided on trainborne OPO equipment which could become fouled or contaminated due to dust or dirt, there shall be a method in the maintenance manual for assessing condition and for cleaning it. OPO-224

Where it is essential that forced cooling is employed on trainborne OPO equipment then the design shall ensure that airborne contaminants such OPO-225

as dust shall not impair the cooling function.

All pins and sockets on trainborne OPO used to pass low voltage signals (5V or lower) shall be gold plated. OPO-226

All pins and sockets on trainborne OPO equipment used to pass low current signals (5mA or lower) shall be gold plated. OPO-227

The fixed end of any connector, which is normally unconnected (e.g. a test point) on trainborne OPO equipment, shall be sealed with a cover such as either a dust cap secured by a flexible link or a lid held closed by a spring. OPO-228

The OPO CCTV System components supplied for installation on the train shall comply with British Standard 'BS EN 60077 Railway applications. Electric equipment for rolling stock. All parts.' OPO-229

All defects of trainborne OPO equipment which can lead to a degraded condition shall be documented with the recommended actions necessary to minimise the consequence. OPO-230

Trainborne OPO equipment shall be designed and manufactured to operate (including start-up and shut down) at full performance under reasonably expected climatic conditions encountered in the operating environment. This shall include changes in environment due to climate change and the consequential extreme weather events. OPO-231

Trainborne OPO equipment shall be designed and manufactured to cope with the fluctuations in climatic conditions between open section and tunnel section running that occur throughout the routes over which that Train operates. OPO-232

Unless otherwise stated, the environmental parameters to be used for any trainborne OPO equipment design shall be in accordance with BS EN 50125-1 'Railway Applications. Environmental Conditions for Equipment - Part 1: Rolling Stock and On-Board Equipment'. The Altitude Class shall be A2, Temperature Class T1 and Snow Class S1. OPO-233

Trainborne OPO equipment shall be immune to the effects of very high levels of humidity. OPO-234

The heat emitted by the trainborne OPO equipment and its principal components under a range of different operating conditions shall be declared at tender and confirmed during the design review and type test stages. OPO-235

The performance and function of the trainborne OPO equipment shall not be affected by dust, pollen, seeds and similar airborne particles. OPO-236

Any network ports, for maintenance use, on the trainborne OPO CCTV equipment shall be directly compatible with an industry standard laptop PC so that bespoke interfacing hardware such as special leads, interface boxes and dongles shall not be required between them. OPO-237

When the time of day is displayed to the user on trainborne equipment, it shall show the daylight saving time (DST) during the daylight saving period. OPO-238

There is no requirement for time clocks that are internal to trainborne OPO-239

equipment to operate in any particular time system (GMT, BST or UTC etc.) as long as the presentation to the user is the correct local time. For clocks showing time to Train Operators, maintainers and passengers the daylight saving time will be sufficient. For time showed on logged data and printouts it is suggested that UTC and daylight saving time are both shown so that the data recorded during the time when the clocks change can be shown correctly.

The trainborne equipment shall automatically insert 29th February in leap years. OPO-240

Trainborne OPO equipment shall be protected against dust, water and snow ingress and shall provide the required functions and reliability accounting for any residual ingress. OPO-241

The level of sealing for trainborne OPO equipment cases, boxes and enclosures shall be to IP67 in accordance with British Standard BS EN 60529 'Degrees of Protection Provided by Enclosures (IP code)' except where it can be demonstrated to the Purchaser that a lower rating is adequate based on the equipment within and the location of the case, box or enclosure. Allowance shall be made for the degradation of seals over time. OPO-242

Equipment case sealing for trainborne OPO equipment shall be designed such that repeated opening and closing of cases shall not affect the integrity of the sealing such that it degrades below standard before the next planned maintenance interval for that seal. OPO-243

Materials used for the trainborne OPO equipment shall be: OPO-244

- a) suited to the environment in which they are required to perform their function; and
- b) resistant to damage from substances in use on or about the railway.

The hours of operation of the trainborne OPO equipment shall be twenty two (22) hours a day during normal operation. OPO-245

The hours of operation of the OPO trainborne equipment shall allow for trains operating throughout the night on three consecutive nights each week. This may amount to approximately ninety (90) hours of continuous running. OPO-246

The *Contractor* shall work with the Rolling Stock Manufacturer to support the use of mock-ups of trainborne underframe mounted equipment so as to demonstrate that the Train can be maintained in the depot environment. OPO-247

All interactions between maintenance staff and the train borne OPO equipment shall be identified and subjected to appropriate analysis and design activities as part of the design development process in compliance with TfL Standard S1217 'Integration of Human Factors into Systems Development'. OPO-248

Trainborne OPO equipment shall be designed and constructed so as to prevent corrosion, including that arising from dissimilar metals and the effects of water, cleaning fluids and graffiti remover. OPO-249

Any trainborne OPO equipment located within the train interior shall be OPO-250

resistant to unauthorised access/removal, vandal attack and tampering.

Surface finishes on trainborne OPO equipment shall achieve a result of Slight (or better) when tested in accordance with British Standard BS AU 148-15 'Methods of test for motor vehicle paints - Part 15: Resistance to chipping'. OPO-251

Surface finishes on trainborne OPO equipment shall be free of defects, corrosion and blistering greater than (two) 2 millimetres from the cut when exposed for one-thousand (1000) hours in accordance with British Standard BS EN ISO 9227 'Corrosion tests in artificial atmospheres - Salt spray tests'. OPO-252

Exterior finishes for trainborne OPO equipment fitted below the solebar shall be compatible with the requirements for corrosion resistance. OPO-253

All items of trainborne OPO equipment that may present hazards shall be identified and suitable warning labels, of a nature and location that effectively protect both the knowing and the unwary from those hazards, shall be fitted. OPO-254

DANGER or CAUTION signage shall be used on trainborne OPO equipment to alert the reader to the possibility of personal injury. OPO-255

WARNING signage shall be used on trainborne OPO equipment to alert the reader to the possibility of damage to the equipment. OPO-256

Signage on trainborne OPO equipment shall be located in a position which does not create an additional hazard. OPO-257

Signs on trainborne OPO equipment shall identify and warn against hazards arising from predictable equipment malfunctions. OPO-258

Signs on trainborne OPO equipment shall be fitted in sufficient number in prominent positions to ensure that they are visible from any position from which exposure to the hazard is possible. OPO-259

Safety signs on trainborne OPO equipment shall conform to the requirements of British Standard BS ISO 7010 'Graphical Symbols - Safety Colours and Safety Signs - Registered Safety Signs'. OPO-260

Signage for staff on trainborne OPO equipment shall be provided in accordance with section 3.8 of TfL Standard 1-382 'Train Decor Design'. OPO-261

Colours used for trainborne OPO equipment signage shall conform to the LUL corporate colour scheme as defined in Reference Document 'London Underground Signs Manual'. OPO-262

Safety signs on trainborne OPO equipment shall be clearly legible to persons with normal or corrected eyesight at distances in the range 0.4 metre to 1 metre from the sign. OPO-263

The sign viewing distance requirement for trainborne OPO equipment shall be met for viewing angles of up to 60° from a normal to the sign, and in all directions. OPO-264

Safety signs for use on the outside of trainborne OPO equipment cases shall use recessed lettering to ensure legibility. OPO-265

- Signs and labels mounted on trainborne OPO equipment fitted to the exterior of the train shall not suffer degradation as a result of regular exposure to train washing and the environment. OPO-266
- Materials used in adhesive signs and labels on trainborne OPO equipment shall resist unauthorised removal. OPO-267
- Trainborne OPO equipment shall comply with British Standard BS 6853 'Code of Practice for Fire Precautions in the Design and Construction of Passenger Carrying Trains'. OPO-268
- Cables used in trainborne OPO equipment shall be compliant with British Standards BS EN 50306 'Railway Applications. Railway Rolling Stock Cables having special Fire Performance' or British Standard BS EN 50264 'Railway Applications. Railway Rolling Stock Power and Control Cables having special Fire Performance' or British Standard BS EN 50382 'Railway Applications. Railway Rolling Stock High Temperature Power Cables having special Fire Performance' may be used on trainborne equipment, but compliance with R15 and R16 of British Standard BS EN 45545-2 'Railway Applications. Fire Protection on Railway Vehicles. Requirements for Fire Behaviour of Materials and Components' shall be demonstrated. OPO-269
- Trainborne OPO equipment shall be appropriately integrated into the train systems for the function concerned. OPO-270
- The trainborne OPO equipment shall comply with Reference Document 2004/108/EC 'The approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC', Reference Document UK SI 2006 No. 3418 'The Electromagnetic Compatibility Regulations 2006' and with Reference Document 2014/30/EU 'The harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast)'. OPO-271
- All trainborne OPO equipment shall comply with the shock and vibration requirements stated in British Standard BS EN 61373 'Railway Applications. Rolling Stock Equipment. Shock and Vibration Tests'. OPO-272
- Structural integrity shall be maintained throughout the defined life of the trainborne OPO equipment whilst ensuring that weight and material usage is optimised. OPO-273
- All items of trainborne OPO equipment shall remain securely attached under normal operating conditions and as far as is practicable, during collisions or derailments. OPO-274
- The effect of all mounting holes and brackets, access holes and other stress concentrating features shall be assessed in the design of trainborne OPO equipment. OPO-275
- Trainborne OPO equipment and mountings shall be designed to take into account the consequences of failure. OPO-276
- Connectors on trainborne OPO equipment shall lock in position when fully mated. It shall be evident to the person making the connection that the lock has been achieved and that the connector is fully mated. OPO-277

- All trainborne OPO electrical equipment shall be free from swarf. OPO-278
- The number and type of fixings for trainborne OPO equipment shall be chosen to enable the shortest removal and replacement times commensurate with safety and security. OPO-279
- Trainborne OPO part removal and replacement shall be assessed in terms of manual handling to ensure that the activity can be undertaken by the target user population. OPO-280
- To support the easy reassembly of trainborne OPO equipment, alignment pegs shall be used where applicable. OPO-281
- Removal and refitting of trainborne OPO equipment shall be demonstrated to meet good Human Factors and Health and Safety principles. OPO-282
- Where a trainborne OPO part is of a size, weight, and within a reach envelope, that together result in a reasonable expectation that removal of that part should be accomplishable by a single maintainer, the design of fixings, supports and attachments shall meet that expectation. OPO-283
- Where sub-assemblies of trainborne OPO parts are unsuitable for lifting by one person, then a means shall be provided to allow lifting/lowering by suitable lifting equipment (e.g. slings or chain tackles or lifting tables). Where lifting eyes or lugs are required to effect safe lifting, but cannot be accommodated permanently due to space constraints, then tapped holes for screwed lifting eyes may be provided as an alternative, in which case the holes shall be used for no other purpose. OPO-284
- Handles or handholds shall be provided on trainborne OPO Parts whenever their omission would lead to difficulty during removal or replacement. OPO-285
- Where individual trainborne OPO modules or parts cannot be removed/refitted by a single person, they shall be arranged such that they can be easily manoeuvred into and out of position with the aid of lifting/lowering equipment, taking full account of the location of the equipment, depot facilities and access limitations. OPO-286
- Where connectors of the same type and form are in close proximity, a means of preventing wrong connection to trainborne OPO equipment shall be employed. OPO-287
- An line replaceable unit LRU is defined as a part which can be replaced as part of first line maintenance to rectify faults. This could be an item which is a sub-component of another assembly, which itself could be changed out.* OPO-288
- Trainborne OPO LRUs shall wherever possible utilise standard fixings, seals and connections to facilitate their removal and fitment. OPO-289
- Electrical connections to trainborne OPO LRUs shall be via multi-pin connectors. OPO-290
- Trainborne OPO LRUs shall be provided with an identification label indicating key parameters, including where appropriate description, type, where used, setting, version, modification status, part number, unique OPO-291

serial number.

When the trainborne OPO LRU is installed on the train in the final position, the identification label shall be visible to the maintainer without the need to dismantle or remove other equipment. OPO-292

All labelling shall remain legible for the whole life of the trainborne part, including overhaul processes and cleaning. OPO-293

Trainborne OPO LRUs shall be provided with industry standard electronic identification and tracking tags (e.g. RFID tagging). OPO-294

Trainborne OPO LRU identification tags shall be permanently attached and shall not be degraded by the operating environment. OPO-295

05.3.5 Reliability, Availability and Safety (RAMS) OPO-296

The supplier shall submit a system assurance plan, compliant with TfL Standard S1538 Assurance, detailing procedures and schedules for conduct of the Safety Engineering, Reliability Engineering, Availability Engineering, Maintainability Engineering, and Human Factors Engineering and comply with BS EN 50126 Railway Applications -The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS), BS EN 50128 Railway applications - Communication, signalling and processing systems, BS EN 50129 Railway applications - Communication, signalling and processing systems, BS 5760 Reliability of systems, equipment and components, BS 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems and BS ISO/IEC 15288 Systems Engineering — System Life Cycle Processes. OPO-297

The management and delivery of safety and technical assurance shall comply with TfL Standard S1538 Assurance. OPO-298

Predictions of quantitative characteristics of reliability, maintainability and availability of all elements of the system and equipment shall be in accordance with BS EN 50126 Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) and BS 5760 Reliability of systems, equipment and components. OPO-299

The *Contractor* shall ensure that assets/sub-systems are designed such that single points of failure are eliminated as far as practicable. OPO-300

Where it is not possible to completely design out single points of failure, then the systems design shall be such that the occurrence of a failure at a single point of failure is self-revealing. OPO-301

The OPO CCTV System shall incorporate a 60 minute Uninterruptable Power Supplies (UPS) rated to suit the specific application in accordance with the requirements specified in TfL Standards S1069 Low Voltage Electrical Installations and S1909 Requirements for Matching Electrical Loads to Low Voltage Supplies. OPO-399

The *Contractor* shall ensure that the OPO CCTV System can be routinely proof tested by the user, at appropriate intervals, without special training. OPO-302

For all new installations, the system architecture shall be scalable for all reasonably foreseeable growth and change, permitting anticipated OPO-303

hardware and software upgrades throughout the system's life cycle.

The OPO CCTV System shall be designed and installed to minimise to ALARP the occurrence of common cause failures. OPO-304

A controlled method of acceptance and commissioning shall be provided, together with test methods and principles, to ensure objectively that the system's performance and tolerances meet the operational requirements. OPO-305

All elements of the OPO CCTV System shall provide protection against vandalism and exposure to the environmental influences of the specified LUL service environment. OPO-306

All active elements of an OPO CCTV System shall incorporate diagnostic features to permit the efficient diagnosis and correction of hardware and software problems. OPO-307

The OPO CCTV System shall provide interfaces to permit routine monitoring and testing of the agreed metrics, during operational use, without degradation of service. OPO-308

The OPO CCTV System shall monitor and detect faults or failure of the station based equipment including the imaging system & transmission system equipment. OPO-309

The OPO CCTV System shall notify the OCS when a failure of the station based equipment is detected. OPO-310

The OPO trainborne equipment shall report fault information and diagnostic data to the train management system. OPO-311

The TCMS will present information to the Train Operator and/or send the information off the train to support maintenance of the train and operation of the service.

Fault identification information shall contain sufficient information to allow a maintainer to select the most appropriate and speedy resolution quickly. OPO-312

The OPO CCTV System shall be designed to minimise the maintenance requirements by the use of good design and health monitoring where practicable. OPO-313

The OPO CCTV System shall incorporate automated checking of benchmark images in order to detect any changes camera alignment. OPO-314

In the event of a camera being detected as being out of alignment resulting in a disparity to the benchmark images, the OPO CCTV System shall send an alarm to the OCC. OPO-315

The OPO CCTV System shall be designed to minimise the need for cable maintenance, where practicable. OPO-316

The *Contractor* shall prepare a RAM Plan that will demonstrate by Failures Modes and Effects Criticality Analyses (FMECAs) how the target for Service Affecting Failures will be met. The FMECAs shall encompass the train-borne equipment and station/ infrastructure based equipment. OPO-317

All Asset software shall be capable of performing its required functions OPO-318

with the minimum service disruption.

The OPO CCTV System shall be designed such that in the event of failure occurring, quick identification and remedy is facilitated with the minimum of disruption to service. OPO-319

It shall be possible to access components for repair, overhaul and test with a minimum of dismantling and disturbance to other parts. OPO-320

As far as reasonably practicable, access to items that need to be routinely removed shall not be restricted by other parts that would need to be removed or adjusted to enable the actual maintenance activity to commence. OPO-321

The OPO CCTV System shall be designed such that defective items can be replaced in a safe and efficient manner. OPO-322

Equipment installed on the track or near the 4-foot shall be designed to require minimal maintenance. OPO-323

The OPO CCTV System shall be designed that the status and condition of parts subject to inspection, adjustment or replacement are accessible remotely, where practicable. OPO-324

The OPO CCTV System shall be designed such that the need for specialist tools, test equipment and software is as low as practicable. OPO-325

The OPO CCTV System shall be designed to allow requisite corrective and preventive maintenance to be undertaken during traffic hours, to the maximum extent practicable. OPO-326

The OPO CCTV System shall be designed such that equipment is readily, quickly and safely accessible to maintenance personnel for all defined maintenance activities during traffic hours, where practicable. OPO-327

The OPO CCTV System shall be designed such that all new and modified equipment has adequate access for inspection, maintenance, testing and repair. OPO-328

The OPO CCTV System design shall comply with the DTUP RAM Management Plan. OPO-329

05.3.6 Human Factors OPO-330

The *Contractor* shall ensure that OPO CCTV System is designed to account for the cognitive capabilities and limitations of the end users (Train Operators, maintainers, customers). OPO-331

The *Contractor* shall ensure that the OPO CCTV System is designed to account for the physiological and biomechanical capabilities and limitations of end users (Train Operators, maintainers, customers). OPO-332

The *Contractor* shall design the OPO CCTV System to ensure operability and maximum usability by end users (Train Operators, maintainers, customers). OPO-333

The *Contractor* shall ensure that the OPO CCTV System is designed to support the desired performance by the end user (Train Operators, OPO-334

maintainers, customers).

The *Contractor* shall ensure that the OPO CCTV System is designed to maintain the wellbeing of end users (Train Operators, maintainers, customers). OPO-335

The OPO CCTV System shall be designed to ensure that sufficient maintenance and testing access/ working space is provided for end users maintaining and/or testing any new or modified assets. OPO-336

05.3.7 Testing and Commissioning OPO-337

This section should be read in conjunction with CWI 07 Testing and Commissioning. OPO-338

05.3.7.1 Testing and Commissioning Station Specific Works OPO-339

05.3.7.1.1 Testing and Commissioning Station Specific Works – Imaging System (Initial and Final) OPO-340

Before commissioning commences the platform shall be marked out identifying the centre of the PTI and all other alignment marks and camera positions such that the camera location from Platform Datum Pin, lateral distance from the platform edge and height above platform level can be confirmed to meet the design. OPO-341

The camera housing shall be clean with the lens and face plate clear of any smears or dirt. OPO-342

As the DTUP passenger train will not be available until LUL Network Integration testing phase of the programme it will be necessary to use templates/ mock-ups to represent the carriages of the DTUP passenger train. These should be capable of being readily and accurately positioned relative to the track geometry to represent the train at the Platform Stopping Position and the plus and minus 1 metre positions. OPO-343

These templates will also be utilised for validating the actual installation and for commissioning the OPO CCTV System.

Not Used OPO-344

Templates shall be used to represent the DTUP passenger train during the testing and commissioning of the imaging system design. OPO-345

As a minimum the templates shall identify door positions, the end of each carriage body shell and the specified minimum overlap. OPO-346

The Rotakin shall be used to determine that the following target image height (%Rotakin) is achieved at the far points of each camera and indeed throughout the PTI: OPO-347

- a) 16.5%Rotakin for 2 (two) and 4 (four) camera layouts;
- b) 24.8%Rotakin for 6 (six) camera layouts; and
- c) 26.4%Rotakin for 8 (eight) camera layouts.

Note: these are the same target heights specified in Requirement OPO-94.

Temporary platform camera alignment and overlap markings and adjustment templates shall be used to ensure that the alignment in vertical and horizontal planes and the overlap between camera views achieves the following; OPO-348

The camera overlap alignment platform mark shall be clearly visible at the bottom of each image where the actual distance on platform of the centre of the mark is a minimum of 500 millimetres from the point of incidence of lower elevation of camera view.

Note: these are the same as defined in requirement OPO-76.

The vertical view shall provide the height of the PTI Corridor determined at the conceptual design phase. OPO-349

This is to ensure that height of the PTI Corridor satisfies the requirement to be from the platform to height of door aperture of the DTUP passenger trains when berthed in the platform or 2 metres whichever is the greater.

Note: these are the same as defined in requirement OPO-88.

Lateral cropped views on an empty platform, shall provide the following while maximising coverage of the platform: OPO-350

- a) not less than 590 millimetres of the train measured at platform level (to ensure visibility of the tops of the doors); and
- b) any gap between train and platform.

Note: these are the same specified in requirement OPO-89

The overall coverage of the PTI Corridor shall be 100% without any blind spots. OPO-351

Lateral cropped views shall provide a continuous view of the Critical Area of the PTI Corridor when a 1.7 metres high barrier (representing a crowded platform) is placed 400 millimetres behind the platform edge. As a minimum this shall include coverage of the Critical Area of the PTI Corridor: OPO-352

- a) not less than 590 millimetres of the train measured at platform level (to ensure visibility of the tops of the doors);
- b) any gaps between the train and platform; and
- c) the full width of the white line (100 millimetres) on the edge of the platform where this is not hidden by the train.

Note: these are the same specified in requirement OPO-91.

For platforms where six (6) and eight (8) cameras are installed compliance with requirement OPO-91 shall be verified by through the use of a 1.7 metre high flexible barrier erected 400 millimetres behind the platform edge. OPO-353

It is permissible to achieve compliance with the above requirement OPO-353 in sections along the platform, providing such a barrier is continuous from an individual cameras position to the cameras far point. OPO-354

As a minimum the 1.7 metre barrier shall be continuous from an individual camera's position to that camera's far point. OPO-355

The resolution of the camera assembly and any processing at platform OPO-356

level shall be measured in TV Lines Per Picture Height (TVLPPH) and mm/cycle as follows:

- a) place Rotakin target at near point of each camera and identify that the “F” Band can be clearly seen on the display being used to measure the performance;
- b) move the target away from the camera along the PTI, target height diminishing and reference Band “F” reducing in clarity until it ceases to be clearly visible. At this position move the target back so that the point at which the band can just be clearly seen is located;
- c) measure the target height by use of an overlay template on an under scanning display (>400TVL resolution) or use a pixel count (thus removing over-scanning errors). Tabulate the results of height and relevant “F” Band mm/cycle and location relative to the platform reference Platform Datum Pin;
- d) repeat for successive mm/cycle bands to the far point for the camera; and
- e) repeat the above down the platform for each camera towards the head and tail wall respectively.

Legacy equipment may be present at the end of platform within the defined area of coverage. This may include Platform End Barriers and legacy OPO monitor assemblies and / or mirrors. The gates of Platform End Barriers may be tied in the open position to allow line of sight the Rotakin. OPO-357

There may be a limited number of convex platforms where legacy equipment obscures the view of the Rotakin positioned between the white and yellow line. In these circumstances it is permissible to cantilever the Rotakin from the platform providing the reference bands are within the field of view of the camera. OPO-358

Where the gate on Platform End Barriers obscures the view of the Rotakin the gate shall be secured in the open position to facilitate validation of the concept design. OPO-359

On concave platforms where legacy equipment obscures the view of the Rotakin, the Rotakin shall be cantilevered from the platform edge providing the reference bands remain within the field of view. OPO-360

Should a location be identified where it proves impossible to site the Rotakin (e.g. due to legacy equipment at the end of a platform), the Rotakin shall be placed as close to the far point position as practical and benchmark images captured in that position. In such cases calculations shall be provided to provide assurance that the minimum target images size will be achieved at the far point of the PTI Corridor. OPO-361

Lighting surveys shall be carried out to highlight any shortfall in lux levels on any platforms where the performance of the camera assembly may not be able to provide a safe solution in order for the operator to carry out their tasks. OPO-362

The measurement of the illumination shall be carried out by placing a calibrated light meter on the platform in the centre of the PTI facing upwards towards the lighting, at least at 1000 millimetre spacing down the platform from end to end. OPO-363

- A walk through test should be undertaken to verify continuity of the camera coverage. OPO-364
- The walk thorough test shall be undertaken by an adult of approximately 1.6 metre high holding a departure Baton above head height but below the 2 metre height of the PTI Corridor. OPO-365
- The walk through test shall consist of a walk of the complete length of the PTI Corridor along the nosing stones. OPO-366
- For platform above ground, additional checks shall be carried out during the day time to ensure all sunlight issues, reflections, and differential lighting have been mitigated. OPO-367
- It shall be verified that all elements of the OPO CCTV System compensate for the full range of variations in ambient lighting conditions including the emergency lighting level needed to cope with degraded modes of operation of the railway. This shall include consideration of glare at all angles of the sun. OPO-368
- On completion of the platform imaging commissioning, the platform alignment overlap marks shall be painted as defined in Appendix 05.3, at the dimensioned locations applicable to the number of cameras used. OPO-369
- Platform alignment overlap markers shall be painted in accordance with TfL Standard S1131 Premises – station platforms. OPO-370
- Every OPO camera housing shall be fitted with a label as shown in Appendix 05.6. OPO-371
- An initial commissioning report for each platform shall be compiled and submitted. OPO-372
- An Initial Commissioning report shall include the following as a minimum: OPO-373
- a) tabulated resolution measurements for Rotakin band F down to band K (depending upon camera range) together with distances from each camera in mm/cycle and TVLPPH;
 - b) all camera settings such as focal length, aperture, object focus setting, where appropriate Synch and burst levels and internal camera settings;
 - c) the dimensions of camera position relative to the platform edge height above the platform and location from Platform Datum Pin;
 - d) images shall be produced for record purposes of the images achieved and details taken of the dimensions of camera position relative to the platform edge height above the platform and location from Platform Datum Pin;
 - e) the uncropped image from each camera;
 - f) the uncropped image from each camera with 1.7 metres barrier 400 millimetres from the platform edge (where applicable);
 - g) cropped and combined images for the platform;
 - h) cropped and combined images for the platform with 1.7 metres barrier 400 millimetres from the platform edge (where applicable);
 - i) a video clip of the complete walk test shall be provided on such

media that replay can be achieved on an industry standard PC;
and

- j) full details of the lighting surveys highlighting any shortfall in lux levels on any platforms where the performance of the camera assembly may not be able to provide a safe solution in order for the operator to carry out their tasks.

05.3.7.1.2 Testing and Commissioning Station Specific Works – Transmission System OPO-374

Each platform transmission installation shall be commissioned according to the manufacturer's specification. OPO-375

Testing of the performance of the transmission shall be undertaken for all moves at every platform. OPO-376

Using equipment mounted on a track trolley to simulate the train, the video performance shall be measured at no greater than 5m intervals throughout the coverage area and documented for acceptance. OPO-377

The average value for video performance throughout the coverage area shall meet the native declared design performance transmission performance. OPO-378

05.3.7.2 LUL Network Integration Testing OPO-379

LUL Network Integration Testing will be undertaken during Engineering Hours to demonstrate compatibility of the DTUP passenger train with both existing and newly installed systems. The Employer leads and coordinates LUL Network Integration Testing. OPO-380

Testing of the performance of the transmission and image grading shall be undertaken for all moves at every platform. OPO-381

The performance of the transmission system shall be measured on the train at regular intervals, carried out at a constant train speed of 8 kilometres per hour throughout the coverage area, and documented for acceptance. OPO-382

The video performance shall be measured on the train at regular intervals, carried out at a constant train speed of 5 miles per hour throughout the coverage area, and documented for acceptance. OPO-383

The average value for video performance through the range shall meet the declared design performance. OPO-384

Image grading will be undertaken by an LU engineer and an operations representative. OPO-385

The following shall be carried out from the operator's normal driving positions: OPO-386

- a) Image grading at the stop position;
- b) Image grading for full run out; and
- c) confirmation of coverage for full run out.

- A walk through test should be undertaken to verify continuity of the camera coverage. OPO-387
- The walk thorough test shall be undertaken by an adult of approximately 1.6 metre high holding a departure Baton above head height but below the 2 metre height of the PTI Corridor. OPO-388
- The walk through test shall consist of a walk of the complete length of the PTI Corridor along the nosing stones. OPO-389
- A full handover pack shall be provided for each station following LUL Network Integration Testing. OPO-390
- The handover pack shall document both the LUL Network Integration Testing and the Initial/Final Commissioning - Imaging System activities and shall include as a minimum the following evidence: OPO-391
- a) tabulated resolution measurements for Rotakin band F down to K (depending upon camera range) together with distances from each camera in mm/cycle and TVLPPH;
 - b) all camera settings such as focal length, aperture, object focus setting, where appropriate Synch and burst levels and internal camera settings;
 - c) Rotakin image height for each camera assembly at the far point;
 - d) the dimensions of camera position relative to the platform edge height above the platform and location from Platform Datum Pin;
 - e) the uncropped image from each camera;
 - f) the uncropped image from each camera with 1.7 metres barrier 400 millimetres from the platform edge (where applicable);
 - g) cropped and combined images for the platform;
 - h) cropped and combined images for the platform with 1.7 metres barrier 400 millimetres from the platform edge (where applicable);
 - i) a video clip of the complete walk test with the train correctly birthed shall be provided on such media that replay can be achieved on an industry standard PC;
 - j) Image grading at stop position;
 - k) Image grading for the full run out for all moves;
 - l) coverage assessment for all moves;
 - m) transmission performance for all moves; and
 - n) video transmission performance for all moves.

Appendix 05.1 - Camera Overlap Diagram

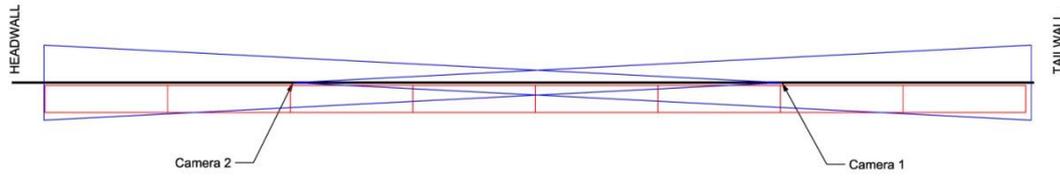


Figure 1 - 2 Camera System

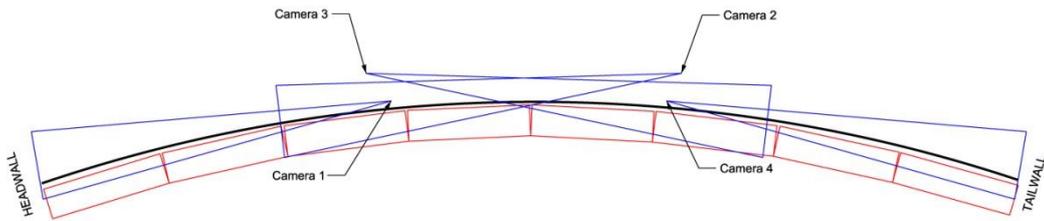


Figure 2 - 4 Camera System

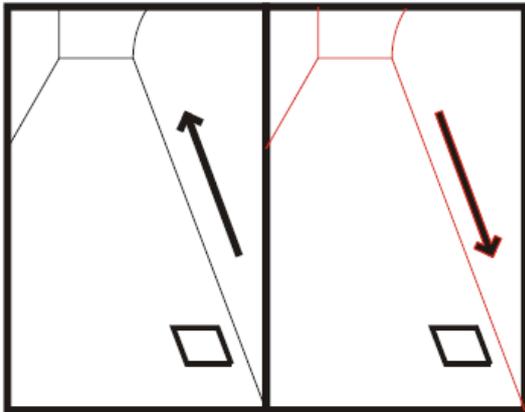
Note: Layout for 2 & 4 cameras and for 6 & 8, the same principle shall apply.

Appendix 05.2 - Image Presentation Layout

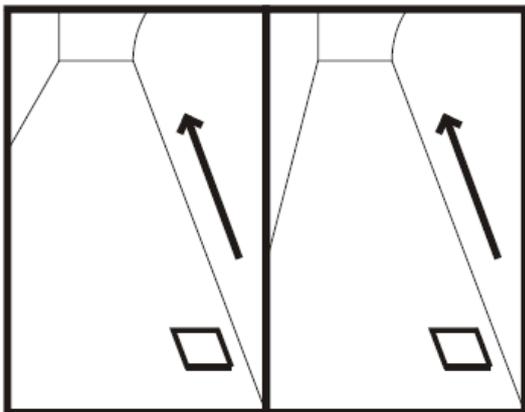
- 2.1 Normal timetable moves (all solutions)
 - 2.1.1 The following drawings outline the logical consistent intuitive approach to image presentation where the relative door controls are adjacent to the correct handed platform image.
 - 2.1.2 The red parts of the images are inverted right to left horizontally, i.e. all tail wall facing camera Images.
 - 2.1.3 The diagrams show the normal arrangement for the displays side by side.
- 2.2 Reversing Moves (all solutions)
 - 2.2.1 For all timetabled reversing moves from normal direction of travel the above applies where the head walls become tail walls for such moves and the hand of the platform changes.
- 2.3 Terminals with platforms on both sides of the train (all solutions)
 - 2.3.1 As both left and right hand platforms are required to be displayed at the same time a slightly different approach is required within the above rules, with the left hand platform on the left and right hand platform on the right. However the head walls are placed in the centre as shown such that the operator can view the crucial part of both platforms with ease, rather than looking at left and right of each screen.

Standard Image Presentation Left Hand Platform for 2 & 4 Cameras

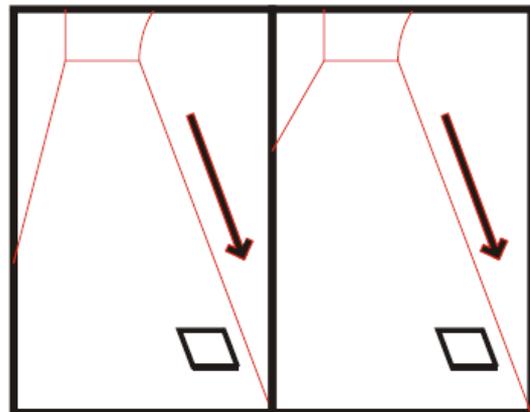
Head wall



Head wall



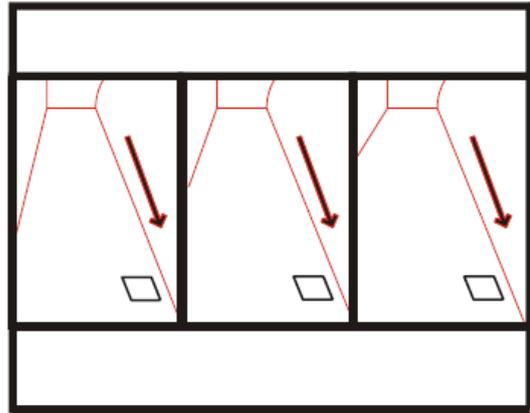
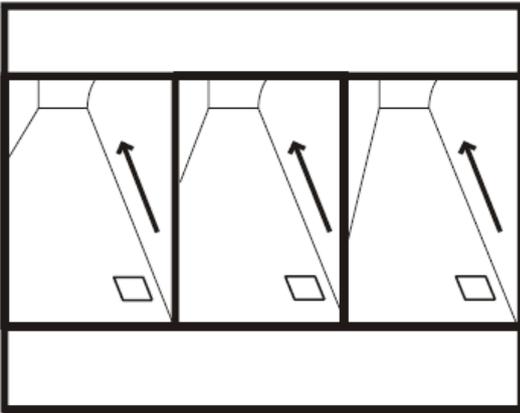
Tail wall



Standard Image Presentation Left Hand Platform for 6 & 8 Cameras

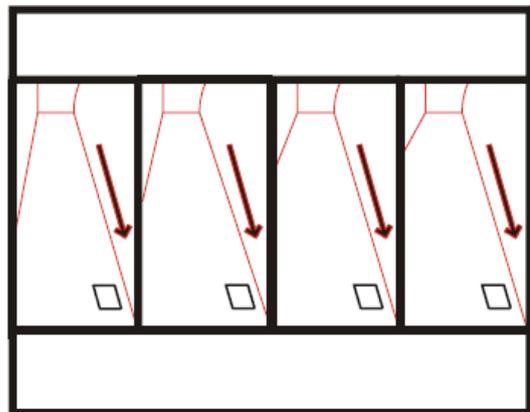
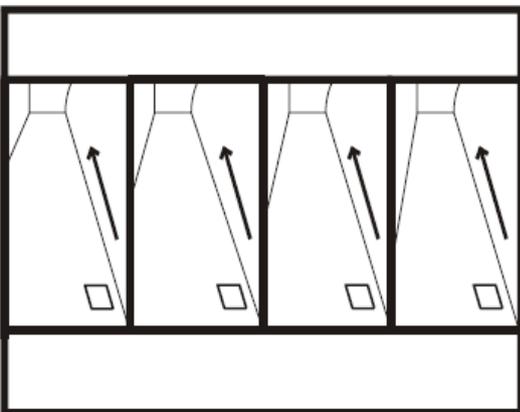
Head wall

Tail wall

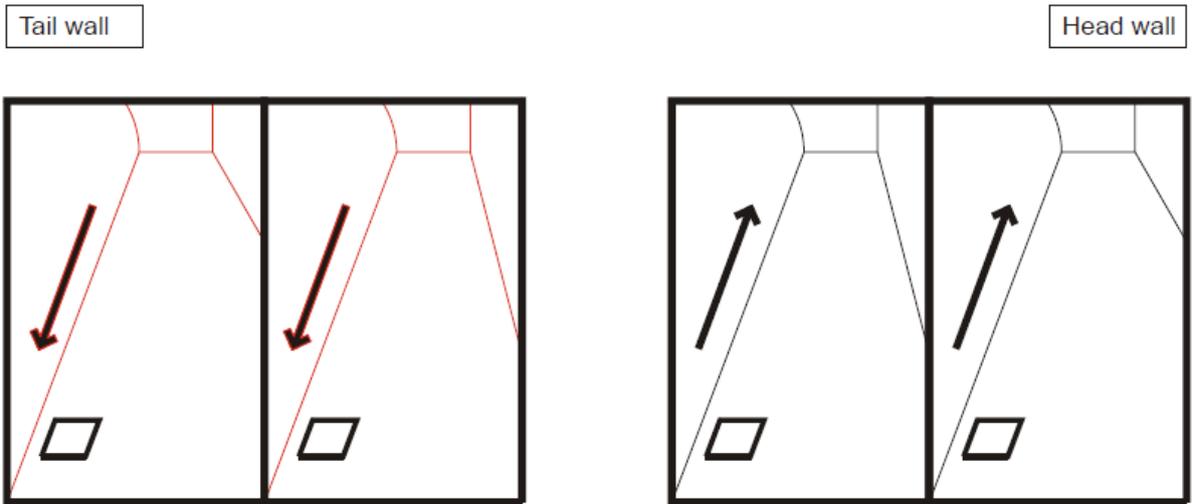
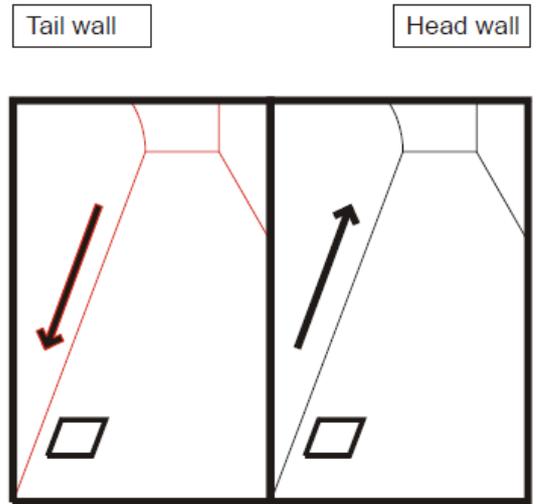


Head wall

Tail wall

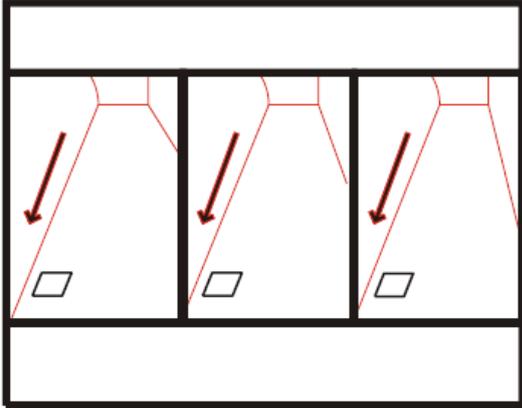


Standard Image Presentation Right Hand Platform for 2 & 4 Cameras

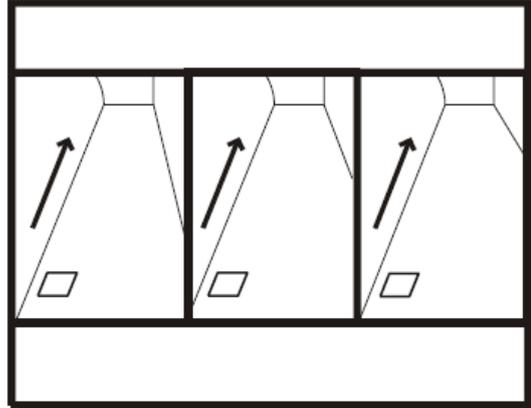


Standard Image Presentation Right Hand Platform for 6 & 8 Cameras

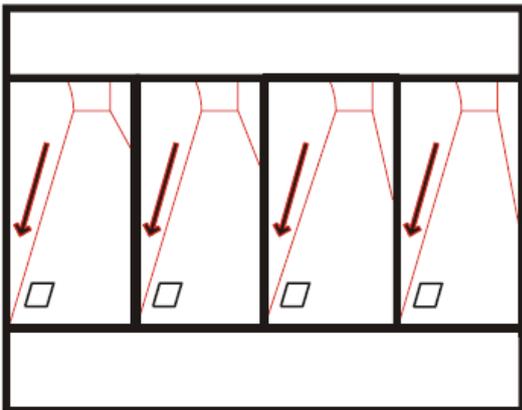
Tail wall



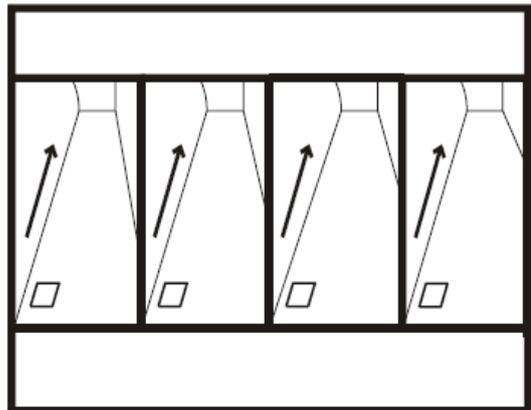
Head wall



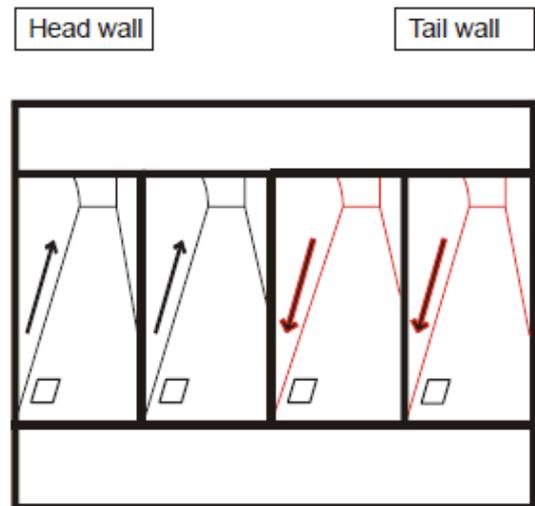
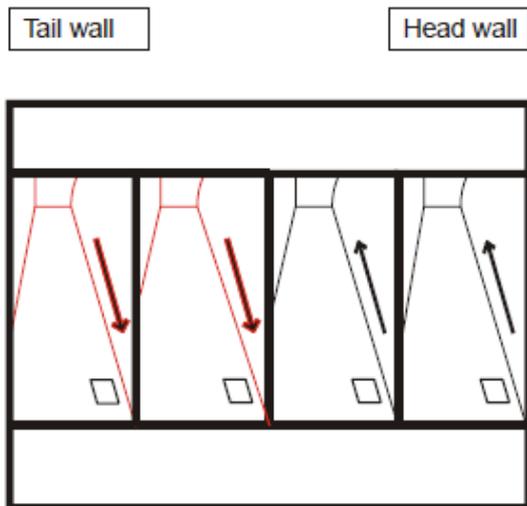
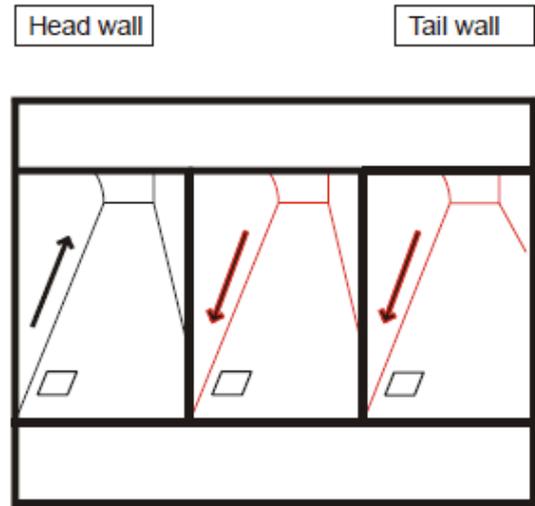
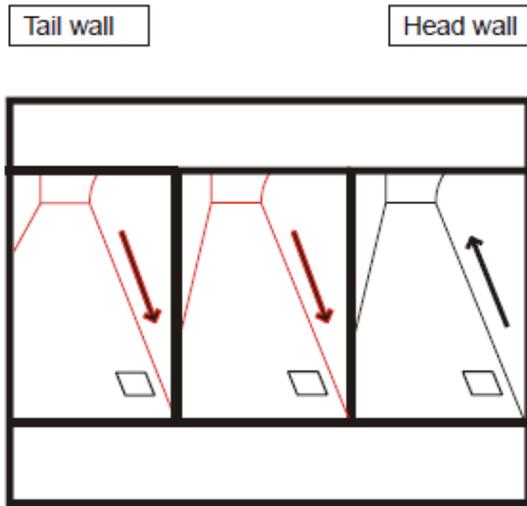
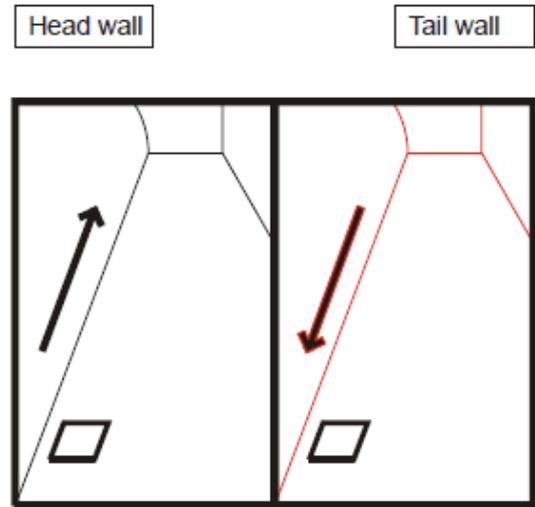
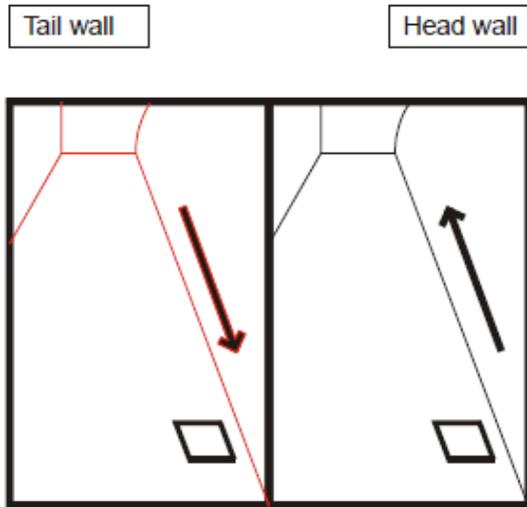
Tail wall



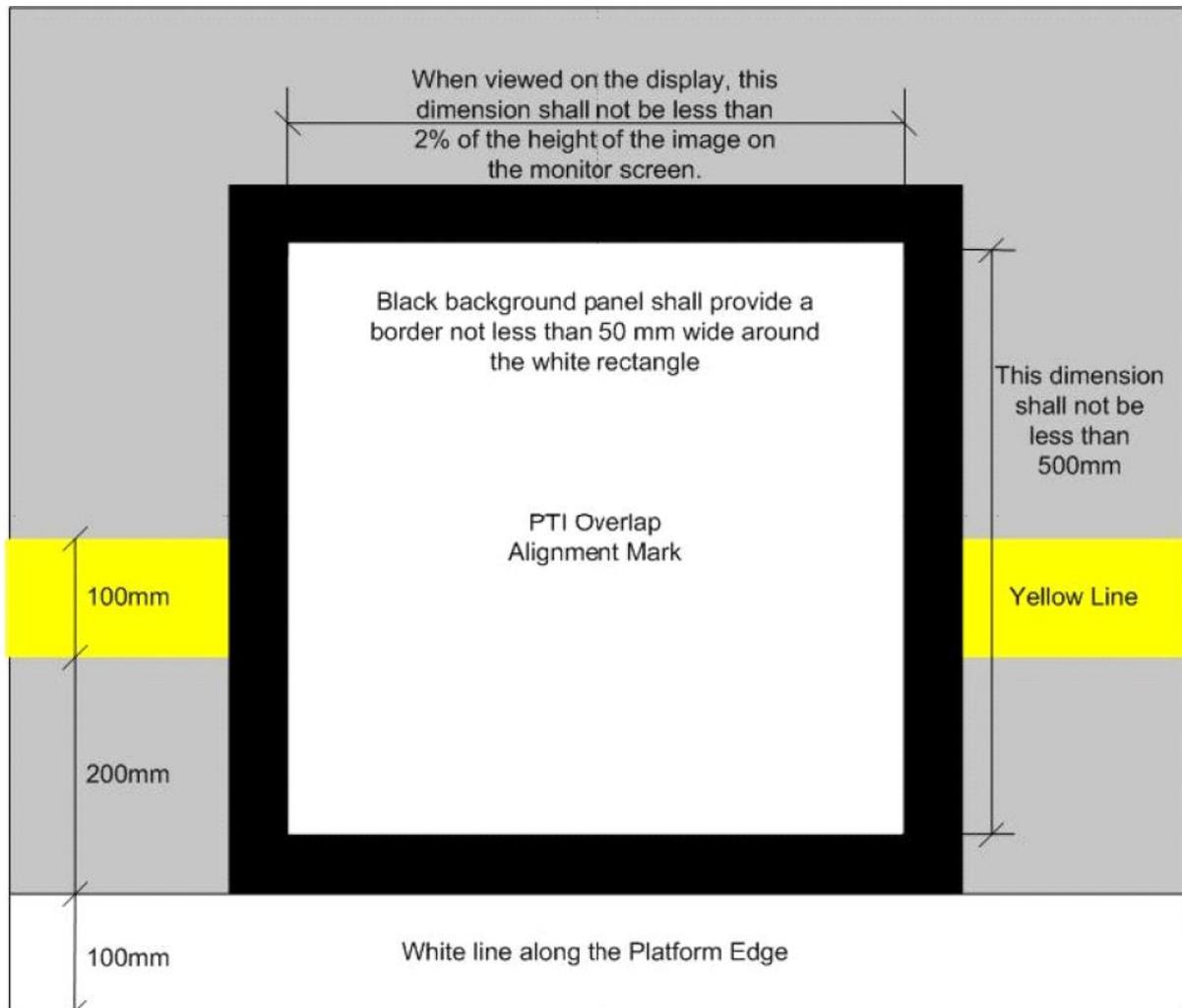
Head wall



Terminal Reversing Left & Right Hand Platforms



Appendix 05.3 - Overlap Marker



Appendix 05.4 - Rolling Stock Performance Data

This attachment provides the maximum run-in (braking) and run-out (acceleration) profiles.

Run-In (Braking) Profile

Location Reference	Distance [m]	Speed [km/h]	Time [secs]
TOR - Platform Entry	-115.22	58.60	0.00
	-110.39	57.36	0.30
	-105.66	56.11	0.60
	-99.52	54.46	1.00
	-95.03	53.22	1.30
	-90.65	51.98	1.60
	-84.96	50.32	2.00
	-79.47	48.66	2.40
	-75.46	47.42	2.70
	-70.28	45.77	3.10
	-65.29	44.11	3.50
	-60.48	42.46	3.90
	-54.73	40.39	4.40
	-50.33	38.73	4.80
	-45.10	36.66	5.30
	-40.15	34.59	5.80
	-34.59	32.11	6.40
	-30.28	30.04	6.90
	-24.72	27.14	7.60
	-19.72	24.24	8.30
	-15.29	21.35	9.00
	-9.93	17.21	10.00
	-5.03	12.24	11.20
Stopping Position	0.00	0.00	14.20

Run-Out (Acceleration) Profile

Location Reference	Distance [m]	Speed [km/h]	Time [secs]
Stopping Position	0.00	0.00	0.00
	5.24	12.52	3.70
	10.26	17.61	4.90
	15.14	21.42	5.80
	20.27	24.80	6.60
	25.38	27.75	7.30
	30.22	30.27	7.90
	34.57	32.37	8.40
	40.17	34.88	9.00
	45.16	36.96	9.50
	50.44	39.05	10.00
	54.87	40.70	10.40
	59.48	42.30	10.80
	65.49	44.21	11.30
	70.48	45.67	11.70
	75.63	47.09	12.10
	79.60	48.12	12.40
	85.02	49.46	12.80
	90.59	50.77	13.20
	94.86	51.72	13.50
Train Length	100.68	52.96	13.90
	105.13	53.87	14.20
	109.66	54.76	14.50
	114.26	55.63	14.80
	120.50	56.77	15.20
	125.27	57.60	15.50
	130.10	58.42	15.80
	135.00	59.22	16.10
	139.97	60.02	16.40
	145.00	60.79	16.70
150.10	61.56	17.00	
155.26	62.31	17.30	
160.49	63.05	17.60	
165.77	63.78	17.90	
169.33	64.26	18.10	

Appendix 05.5 - Extracts From The Rolling Stock Technical Requirements Specification

Throughout this attachment, text in italics is information or advice to assist the reader in understanding the requirements. Text in italics is not requirements.

OPO CCTV Specific Requirements

Requirement Text	Requirement Number
<i>The specification for OPO CCTV equipment here is generic and no specific product should be inferred. The requirements will be refined as part of the Schedule 26 interfacing work.</i>	7132
Provision shall be made for four antennas at each end of the Train for OPO CCTV, they shall be located as follows: <ul style="list-style-type: none"> • The antennas shall be mounted on the side of the Train below floor level positioned for reception from a transmitter underneath the platform nosing. • On both sides of each end car there shall be provision for a pair of antennas, the two antennas of a pair shall be separated longitudinally by no less than 5m. • The outer antenna of each pair shall be as close to the end of the Train as possible. 	2168
The space provided for the OPO CCTV receiver shall be in the form of one 19" rack mount which is 450mm deep.	2169
The 19" rack mount for the OPO CCTV receiver shall be at least 2U high.	2171
Provision shall be made for an OPO CCTV receiver in each end car.	2170
Provision shall be made for a power supply of approximately 200W per Train for the OPO CCTV equipment.	2174
All cabling (for both power and data) shall be provided by the Manufacturer as required by the OPO CCTV equipment.	6870
Where the OPO CCTV equipment requires the video signal to be transmitted from one end of the Train to the other, the cable provided by the Manufacturer for this purpose shall be designed and installed to provide a robust, reliable, low-loss transmission of the signal.	7138
<i>To maintain transmission of video from the platform to the Train during the whole of the Trains run-out from the platform, the OPO CCTV equipment is likely to be configured to receive the transmission at the rear of the Train.</i>	

The through-Train transmission to the display screens at the front of the Train is therefore a critical feature.

Where the OPO CCTV equipment requires the video signal to be transmitted from one end of the Train to the other, the quantity of interconnections in the cable provided by the Manufacturer for this purpose shall be minimised. 7139

Provision shall be made for adequate ventilation and cooling as required by the OPO CCTV equipment. 5301

OPO CCTV images shall be displayed to the Train Operator: 5703

- whilst the Train is stationary at the platform stop position.
- immediately prior to the Train coming to a stand at a platform stop position i.e. within the stopping window of the nominal stopping position.
- during platform departure, until the Train has cleared the platform.

The delay between the output of the OPO CCTV receiver at the front of the Train, and the presentation of the OPO CCTV images on the display screens, shall be less than 15ms (starting with the last pixel output of the OPO CCTV receiver). 7141

The latency of the OPO CCTV system must be low so that there can be near real-time interaction with events on the platform.

The Train shall not cause the displayed OPO CCTV images to freeze, showing an image that is no longer real-time. 7136

Any faults in the Manufacturer's scope of supply that could cause the OPO CCTV image to not be a correct likeness of the signal being received by the Train shall result in the OPO CCTV display being blanked. 7137

OPO CCTV images shall not be displayed at stations timetabled as non-stopping. 5704

OPO CCTV images shall not be displayed until the Train speed has reduced below 10km/h. 5867

Relevant Cab Requirements

Display screens shall be provided in the cab which: 3340

- are capable of displaying no fewer than eight OPO CCTV video images of the PTI;
- permit interaction with the Train via a touch interface;
- display touch controls (soft keys) and information displays as

required to support the Train control and monitoring functions;	
<ul style="list-style-type: none"> • display touch controls (soft keys) and information displays as required to support the interface with RCS; • display information associated with remote control of Train functions via the OTC; • display images from the Train-based CCTV systems as required. 	
The display screens in the cab shall be shared and sub-divided as required, ensuring that images and controls are available for use at the time that they are required and that information from different sources can be shown without having to assign one display to one source.	4245
The dimensions of the display screen area required for displaying OPO CCTV images shall be sufficient to achieve conspicuity of the target of not less than 95%.	5707
<i>For a display screen aspect ratio of 4:3, two images shall be displayed side-by-side cropped at 50% width. Where 3 or 4 images are to be displayed on a screen of this aspect ratio, further cropping and zooming shall occur and the images displayed side-by-side.</i>	
For OPO CCTV image display, the viewing angle of the captured target (2 year old British female 825mm tall and 150mm chest depth including clothing) shall be for all viewing positions no less than 54 minutes of arc subtended to the operators eye when viewed normal to the plane of the displays, and never less than 42 minutes of arc subtended to the operators eye.	5708
<i>OPO CCTV images of the PTI have to achieve conspicuity (probability of detection) of not less than 95% for a 2 year old British female (825mm tall and 150mm chest depth including clothing) throughout the critical area of the defined PTI. The OPO CCTV performance Nomogram in LU Standard G150 'Manual of Good Practice - Telecommunications - OPO CCTV Systems' (and the accompanying explanatory notes) illustrates the relationships between the viewing angle subtended at the observer's eye, viewing distance, screen size, image height ratio (%C), and conspicuity.</i>	5705
The screens for displaying OPO CCTV images in the cab shall have a resolution of no fewer than 400TVL per picture height.	5709
OPO CCTV images shall be clear under all lighting conditions capable of existing in the cab.	4677
The display screens in the cab shall compensate for variations in ambient lighting conditions.	5247
The display screens in the cab shall have a contrast ratio of no less than 300:1.	5710
The display screens in the cab shall be capable of a luminance of no less than 300cd/m ² .	5711

The display screens in the cab shall be mounted side-by-side or one above the other.	5248
The size, position and orientation of any display screen at the operating positions shall take into account: <ul style="list-style-type: none">• The size and shape of images to be displayed, alone or in combination, such that the discernibility of the images is sufficient for their intended purpose.• The range of possible operator eye positions based upon the dimensions of the operators and the available operating positions (including the adjustability thereof).	4855
The Manufacturer shall demonstrate how the facilities provided for the operator reduce the risks associated with the Platform-Train Interface to ALARP.	5947
Controls, displays and windscreens shall be free from glare and reflections.	4538

Appendix 05.6 - Camera Labels



Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 06

Engineering Management

Table of Contents

06.1	General	1
06.2	Glossary	1
06.3	Delivering Together	3
06.4	Technical Queries and Requests for Information	3
06.5	Design Management	3
06.6	Design Review and Progress Meetings	10
06.7	Reliability Availability & Maintainability (RAM)	11
06.8	Human Factors	13
06.9	Electromagnetic Compatibility	14
06.10	Engineering Safety Management	14
06.11	Standards Management	15
06.12	Requirements Management	15
06.13	Configuration Management	15
06.14	Obsolescence Management	15
06.15	Verification and Validation	16
06.16	Assurance	16
	Appendix 06.1 - Human Factors Integration Plan (HFIP)	22

06.1 General

06.1.1 This Common Works Information 06 (CWI 06) sets out the requirements for engineering management, the purpose of which is to ensure the *works* are delivered on time and to the specified quality through robust preparation and planning, and to an assured level of quality, safety and engineering integrity.

06.2 Glossary

06.2.1 The terms and phrases defined in the below table apply to all elements of this CWI 06.

Term	Definition
Assurance	means the provision of evidence given to the <i>Employer</i> for each Assurance Stage to demonstrate that the requirements defined in this contract are being and have been fully realised and Acceptance granted by the <i>Project Manager</i> all in accordance with the procedure described in Common Works Information 06 – Engineering Management and "Assure" and "Assured" shall be construed accordingly
Assurance Plan	the risk based plan produced by the <i>Contractor</i> describing all of the Assurances activities as specified in paragraph 06.16.3.2
Concept Design Submission	means the submission of the Concept Design Submissions for the OPO CCTV System, platform imaging system design(s), OTC – Infrastructure Borne Equipment and Platform Stopping Markers as specified in section 06.5.10
Conceptual Design Report	the report detailing the concept design that shall as a minimum meet the requirements specified in the CWI 05 Technical Requirements.
Conceptual Design Report (Image Capture) Meeting	the meetings held prior to formal submission of the each Survey Report validating the Conceptual Design to present the draft report and benchmark images to stakeholder as specified in paragraph 06.5.12.2
Design Submissions	means the submission of design evidence in relation to a part of the OPO CCTV System, or the installation of OTC – Infrastructure Borne Equipment, Stopping Markers.
Design Management Plan	the plan produced by the <i>Contractor</i> describing all of the design activities as specified in paragraph 06.5.4.3
Design Review and Progress Meetings	the regular meeting to review progress across all design activities and specifically the overall System Design of the OPO CCTV System and the progress towards achieving incremental acceptance as specified in section 06.6.
DTUP Human Factors Issues Log (HFIL)	the log of engineering issues that have Human Factors solutions maintained by the <i>Employer</i> .
LUL Network Integration Testing	LUL Network Integration Testing is undertaken to demonstrate compatibility of the DTUP passenger train with both existing and newly installed systems. LUL Network Integration Testing will be undertaken during Engineering Hours.
Good Time	Sufficient time has been allowed for: <ul style="list-style-type: none"> the provision of the required information;

	<ul style="list-style-type: none"> the time taken for review by the recipient and the provision of any response; taking into account such a response; and the recipient to take any action required of them to control risk. <p>(definition from TfL Standard 1538 Assurance)</p>
Independent Safety Advisor	a specialist Employer-appointed advisor who may conduct audits and reviews of the Contractor's development processes relevant to Engineering Safety Management.
Obsolescence Strategy	the strategy produced by the <i>Contractor</i> that complies with British Standard BS EN 62402:2007 'Obsolescence Management - Application Guide' and LU TfL Standard S1043 Obsolescence Management as specified in paragraph 06.14.2
OTC - Infrastructure Borne Equipment	<p>is the Off Train Communications (OTC) system equipment that is mounted on the infrastructure. The OTC – Infrastructure Borne Equipment is designed and free issued by the Rolling Stock Manufacturer. The OTC System provides the following functionality:</p> <ol style="list-style-type: none"> Correct Side Door Enable (CSDE) functionality ensuring that the train doors can only be opened on the side adjacent to the platform and when the train is stopped within a defined tolerance of the Platform Stopping Position; and Two-way communications link to allow the transfer of data/commands to and from the train while berthed at the platform.
PDP (PDP)	means an organisation whether external to or internal within the <i>Employer's</i> organisation who is contracted to deliver any or all projects associated with the DTUP, including the <i>Contractor</i>
Platform Stopping Markers	Platform Stopping Markers consist of rectangular plates bearing a series of chevron markings to facilitate a train operator stopping at the Platform Stopping Position.
Platform Stopping Position	<p>the Platform Stopping Position is the designated nominal stopping position for the New Train and is used as the datum to determine the position of the Train for design, installation, testing and commissioning of the OPO CCTV System.</p> <p>PSPs for each platform will be shown on drawings issued as part of the Works Information. The Platform Stopping Position is referenced from a datum point at the Platform Datum Pin at the leading end of the train in the direction of departure for a normal move. Dimensions on the drawings are +ve in the direction of travel of the train for a normal move; dimensions to features in the platform are therefore generally shown as -ve on the CAD drawings. Dimensions are taken along the centreline of the track, taken perpendicular from the track centreline.</p>
RAM Management Plan	the plan produced by the <i>Contractor</i> describing the processes and methods the <i>Contractor</i> will use to ensure the OPO CCTV System meets the RAM performance requirements set out in CWI 05 Technical Requirements and SWI 05 Technical Requirements as specified in paragraph 06.7.4.1

Reliability Case	the document produce and maintained by the in accordance with the requirements of TfL Standard S1-212 Production of a Reliability Case as specified in paragraph 06.7.5.1
Technical Information	<p>Technical Information means information and materials required by the <i>Employer</i> in order to operate the OPO CCTV System and the installation of OTC Infrastructure Borne Equipment and Stopping Markers and shall include:</p> <ul style="list-style-type: none"> (a) all calculations, analyses, information and interface information, drawings, records (including design, manufacture, installation, test, commissioning, maintenance and operational records) and data and Documentation; (b) all safety cases, assurance information, approvals (including restrictions on use), hazard and safety risk logs, verification and validation records; (c) the operating and maintenance manuals; and (d) all training materials.
Verification Activity Plan	the risk-based Verification Activity Plan (VAP) produced by the <i>Employer</i> in accordance with clause 3.12.2 of TfL Standard S1538 Assurance and identifying the verification activities to be undertaken by the Employer, if any, to verify the assurance evidence provided the <i>Contractor</i>
4LM Programme	TfL investment programme upgrading the District, Metropolitan, and Circle and Hammersmith & City lines.

06.3 Delivering Together

06.3.1 In order to achieve the outcomes described 06.1.1 above, and without prejudice to any other provision of the Implementation Works Terms, the Parties should observe the following traits:

- a) openness, fairness, honesty and robustness in communication;
- b) the sharing of issues, concerns and observations in an accurate and timely manner;
- c) the Parties actively supporting each other to move forward, avoiding and mitigating constraints as far as possible; and
- d) the Parties setting out expectations and plans in advance, in order to enable preparation and planning to be undertaken effectively by Others.

06.4 Technical Queries and Requests for Information

06.4.1 The *Contractor* shall submit all technical queries and requests for information in relation to the *works* and Standards formally through the *Project Manager*.

06.5 Design Management

06.5.1 The *Contractor* shall ensure that the *works* design and execution are:

- a) planned and managed in accordance with a formal, structured, documented and auditable process;
- b) undertaken by appropriately qualified, trained, experienced and competent personnel; and
- c) subject to regular planned reviews.

- 06.5.2 The works design process shall take into account the full life cycle of the *works* including:
- a) manufacture;
 - b) testing, installation and commissioning;
 - c) hand-over and acceptance;
 - d) maintenance and operation;
 - e) storage;
 - f) disposal and recyclability;
 - g) the collection of service performance, fault and defect information to be made available in an appropriate format to support the efficient maintenance and operation of the *works*; and
 - h) obsolescence, particularly regarding microcomputers, microprocessors, integrated circuits and software.

- 06.5.3 The *Contractor* shall provide evidence for all life cycle aspects of, and processes involved in, the *works*, including but not limited to, design, development, testing, operation, modifications, maintenance and disposal. Evidence shall therefore cover at least the following:

- a) design;
- b) reliability;
- c) quality;
- d) testing;
- e) Interfaces;
- f) maintenance;
- g) maintainability;
- h) operations;
- i) systems integration;
- j) obsolescence;
- k) configuration management;
- l) plans, processes and procedures;
- m) analyses and calculations;
- n) requirements; and
- o) rationale.

06.5.4 Design Management Plan

- 06.5.4.1 The *Contractor* shall submit a Design Management Plan to the *Project Manager* for acceptance no later than six (6) weeks from the Order Commencement Date.

- 06.5.4.2 The Design Management Plan shall cover the OPO CCTV System, OTC – Infrastructure Borne Equipment and Platform Stopping Markers.

- 06.5.4.3 The Design Management Plan shall include:

- a) a description of how the *Contractor* will produce an integrated, assured and certified design and how this will be translated into consistent design, manufacture, installation, testing and commissioning;
- b) a description of how the *Contractor* will undertake the overall OPO CCTV system design with input from the Rolling Stock Manufacturer managed in

accordance with the process specified in Schedule 9 Implementation Work Terms, to achieve incremental acceptance from the *Project Manager*, thereby, enabling detailed design to commence on individual elements of the system ahead of the final acceptance of the system design;

- c) a description of how the *Contractor* will undertake the design for the station specific OPO CCTV System works clearly identifying interdependences with the system design;
- d) a description of how the *Contractor* will produce a single coordinated design for the station specific works for the OPO CCTV System, OTC – Infrastructure Borne Equipment and Platform Stopping Markers;
- e) the design organisation the *Contractor* plans to put in place to undertake the design;
- f) management processes for:
 - (i) configuration management;
 - (ii) technical change control;
 - (iii) hazard management;
 - (iv) Interface management (paragraph 06.5.5);
 - (v) electromagnetic compatibility - EMC;
 - (vi) Standards management (Section 06.10);
 - (vii) systems engineering (paragraph 06.5.5);
 - (viii) requirements management (Section 06.11); and
 - (ix) document management.

Note: The Design Management Plan may reference more detailed plans.

06.5.4.4 The *Contractor* shall keep the Design Management Plan (and any referenced plans) up to date and any revisions to it shall be submitted by the *Contractor* to the *Project Manager* for Acceptance.

06.5.5 Systems Engineering, Integration and Interface Management

06.5.5.1 The *Contractor* shall undertake system engineering, integration and interface management in accordance with Schedule 9 Implementation Work Terms – Systems Engineering, Integration and Interface Schedule.

06.5.6 Engineering "V" Life Cycle

06.5.6.1 The *Contractor* shall implement systems engineering techniques to identify, control and reduce the risks associated with the interaction between the OPO CCTV System, the DTUP passenger stock, all other Interfaces and their effective integration.

06.5.6.2 The *Contractor* shall implement an engineering "V" life-cycle model in accordance with BS EN 50126: Railway Applications.— The specification and demonstration of Reliability, Availability, Maintainability and Safety.

06.5.7 Reviews and Submissions

06.5.7.1 Consultation

06.5.7.1.1 Without prejudice to the formal submission process for Acceptance referred to in paragraph 06.5.7.2 below, the *Contractor* and the *Project Manager* may, prior to the formal submission, consult in the following manner:

- a) provision of draft documents for the *Project Manager's* information and comment to achieve a level of understanding of each Design Submission's content to facilitate a timely formal review; and
- b) between the Design Review and Progress Meetings referred to in paragraph 06.6, the Parties shall maintain an informal dialogue with each other.

06.5.7.1.2 Any review and or failure to review any draft documents by the *Project Manager*, shall not relieve the Contractor from any of its obligations providing formal submissions and for obtaining all necessary acceptances and or approvals, as applicable.

06.5.7.2 Formal submission process for Acceptance

06.5.7.2.1 The Parties shall, notwithstanding paragraph 06.5.7.1.1 above, use the following submission process to exchange Technical Information, and allow the *Project Manager* to review Design Submissions and Accept the relevant Assurance Submissions.

06.5.8 Submission of Technical Information

06.5.8.1 The *Contractor* shall submit Design Submissions to the *Project Manager* for review and Acceptance during the OPO CCTV system design to enable the *Contractor* and *Project Manager* to have confidence that the OPO CCTV System design is progressing correctly in accordance with the requirements.

06.5.8.2 The *Contractor* shall ensure that each of the Design Submissions submitted to the *Project Manager* shall be progressively revised where necessary to include additional information and/or evidence that have been obtained during OPO CCTV System Design activities. Any changes made to the previously Accepted Design Submissions shall be resubmitted for Acceptance.

06.5.8.3 The *Contractor* shall ensure that each Design Submission includes:

- a) identification of the *Contractor's* checking and approval entities, according to the *Contractor's* processes;
- b) a description of the methods followed; and
- c) a description of the formal analyses undertaken.

06.5.8.4 Design Submissions shall demonstrate that:

- a) the requirements of the *Employer* under this contract have been adequately captured and verified;
- b) the requirements have been embodied in the OPO CCTV system design and confirmed throughout the OPO CCTV system design process; and
- c) consideration has been given to the effect that the scope of the Design Submission has, where relevant, on all other parts of the OPO CCTV System or other interfacing assets.

- 06.5.8.5 The *Contractor* shall ensure that all Design Submissions confirm and demonstrate, where appropriate, that:
- a) the proposed OPO CCTV system design can be consistently and reliably achieved in production and be able to be maintained for its design life;
 - b) the OPO CCTV system design will optimise reliability, availability, maintainability and safety having regard for the requirements set out in this Contract; and
 - c) the reliability, availability, maintainability and safety of the OPO CCTV System and its components are achievable and verifiable. The *Contractor* must demonstrate compliance with this requirement using recognised methods.
- 06.5.8.6 The *Contractor* shall ensure that the Design Submissions are identified by a logical, sequential numbering system.
- 06.5.8.7 The *Contractor* shall ensure that there is a regular flow of Design Submissions to avoid delays to the Accepted Programme arising from an uneven workload.
- 06.5.8.8 The *Contractor* shall review and approve design submissions from its *Subcontractors* before submission of these to the Project for review. These design submissions shall be in the same format and level of detail as agreed between the *Project Manager* and the *Contractor*.
- 06.5.8.9 In undertaking a review of a Design Submission the *Project Manager* shall be entitled to review all evidence included or referenced in that Design Submission and on request by the *Project Manager*, the *Contractor* shall provide copies of such evidence to the *Project Manager* in a timely manner.
- 06.5.8.10 The *Contractor* shall ensure that each of the Design Submission reference the applicable Sections of the CWI 05 Technical Requirements, all Applicable Laws and Standards and the *Contractor's* quality procedures as required.
- 06.5.8.11 The *Contractor* shall ensure that all Design Submissions are in a format which allows the *Employer* to use a search facility.

06.5.9 Submission Acceptance

- 06.5.9.1 The *Project Manager* shall either accept a submission or reject it. An explanation for the rejection and any action(s) / issues required to be addressed in the resubmission will be identified for the *Contractor*. The *Project Manager* will review and assign / code each submission with one (1) of the following:
- A - Accepted - work may proceed as proposed;
 - B - Accepted subject to comment - in which case work may proceed subject to incorporation of the changes/actions indicated and the document revised and resubmitted for acceptance;
 - C - Rejected - in which case work should not proceed and the submission must be resubmitted for review and acceptance; or
 - D - Information only - where the *Project Manager* does not intend to review but acknowledges receipt, in which case work may proceed as proposed.

06.5.9.2 Where there is a need to consider the effect the OPO CCTV system design of one subsystem has on another subsystem, the submission of which may be received at a different time, Acceptance may be granted "Subject to" satisfactory review of another subsystem, which shall be at the *Project Managers* discretion.

06.5.9.3 The *Contractor* shall allow fifteen (15) Working Days for the *Project Manager's* review of the *Contractor's* design submissions except for the case where the submission includes interfaces outside the DTUP such as Network Rail and 4LM Programme. In such cases the *Contractor* shall allow twenty five (25) Working Days.

06.5.10 Concept Design Submissions

06.5.10.1 The *Contractor* shall submit Concept Design Submissions for each of the following:

- a) OPO CCTV System (complete);
- b) Platform image system design (for every individual platform *);
- c) OTC - Infrastructure Borne Equipment generic installation; and
- d) Platform Stopping Markers generic installation.

Note *: where two platform faces serve the same track, both platforms are to be included in a single Concept Design Submission.

06.5.10.2 The Concept Design Submissions shall comply with TfL Standard 1538 Assurance and the *Contractor* shall ensure that it contains, as a minimum the following:

- a) a clear explanation of the scope of each section of the submission;
- b) clear drawings, schematics, 3-D models, any documentation, information, design, calculation, parts list, sample, pattern or model, etc. as appropriate;
- c) sufficient text explanation and description of the subject together with calculations, where applicable, to indicate how requirements of the Works Information, CWI 05 Technical Requirements and the Standards will be met;
- d) a clear statement that compliance with the Works Information, CWI 05 Technical Requirements and the Standards will be achieved;
- e) a clear statement that the proposed OPO CCTV System, OTC - Infrastructure Borne Equipment installation, or will be safe, fit for purpose and meet the specified reliability and life expectancy requirements;
- f) a response to each requirement of the Works Information, CWI 05 Technical Requirements Technical Requirements and all Applicable Laws and Standards;
- g) a clear indication of any items which will not be compliant with the Works Information, CWI 05 Technical Requirements Technical Requirements and the Standards and an explanation of the basis for concession requests; and
- h) confirmation that specified reliability and maintainability requirements will be achieved by the proposed Design.

06.5.11 Concept for Platform Image System Design (Image Capture)

06.5.11.1 The *Contractor* shall submit a Conceptual Design Report (Image Capture) for every Platform Image System Design that shall as a minimum meet the requirements specified in the CWI 05 Technical Requirements.

06.5.11.2 Prior to formal submission of the each Conceptual Design Report (Image Capture) for each platform the *Contractor* shall convene a review meeting with key stakeholders to present the draft report and proposed camera layout.

06.5.11.3 The *Project Manager* will determine the attendance list for Conceptual Design Report (Image Capture) meetings.

06.5.11.4 The *Contractor* shall provide the draft Conceptual Design Report (Image Capture) to the attendees of the Conceptual Design Report (Image Capture) Meeting a minimum of five (5) Working Days prior to the date of the meeting.

06.5.11.5 In the interests of efficiency, the *Contractor* shall schedule Conceptual Design Report (Image Capture) meetings that cover more than one platform Conceptual Design Report.

06.5.12 Platform Conceptual Design Validation (Image Capture)

06.5.12.1 The *Contractor* shall submit a survey report validating the Conceptual Design (Image Capture) for every platform. As a minimum the survey report shall meet the requirements specified in the CWI 05 Technical Requirements.

06.5.12.2 Prior to formal submission of the each Survey Report validating the Conceptual Design for each platform the *Contractor* shall convene and a review meeting with key stakeholders to present the draft report and benchmark images.

06.5.12.3 Survey Reports shall be reviewed in the Conceptual Design Report (Image Capture) meeting specified in 06.5.11.2.

06.5.12.4 The *Contractor* shall provide the draft Survey Report (Image Capture) to the attendees of the Conceptual Design Report (Image Capture) meeting a minimum of five (5) Working Days prior to the date of the meeting.

06.5.12.5 In the interests of efficiency, the *Contractor* shall schedule Conceptual Design Report (Image Capture) meetings that cover more than one platform Conceptual Design Report / Survey Report.

06.5.13 Station installation design submissions

06.5.13.1 The *Contractor* shall submit a single coordinated design for the installation of the station specific works for the OPO CCTV System, the OTC – Infrastructure Borne Equipment and the Platform Stopping Markers. The design shall include, but is not limited to the following:

- a) Camera installation;
- b) Equipment room installation (OPO CCTV System & OTC – Infrastructure Borne Equipment);
- c) Leaky feeder installation;
- d) OTC – Infrastructure Borne Equipment installation (RFID tags & Wi-Fi antennas);
- e) Cabling and containment; and
- f) Stopping Position Marker installation.

06.5.13.2 The submissions shall contain evidence of the development of the Design since acceptance of the Concept Design Submission(s) (where relevant) and clear evidence of compliance with the Works Information, CWI 05 Technical Requirements and the Standards. Specifically the Design shall provide clear evidence of the following:

- a) That the Design takes cognizance of all known asbestos and avoids such areas (where possible) in an efficient way; and
- b) The Design maximises the use of existing cable route management systems.

06.6 Design Review and Progress Meetings

06.6.1 The Design Review and Progress Meetings shall:

- a) Review progress across all design activities and specifically the overall System Design of the OPO CCTV System and the progress towards achieving incremental acceptance, thereby, enabling detailed design to commence on individual elements of the system ahead of the final acceptance of the System Design;
- b) be used to agree the content and scope of all design submissions;
- c) ensure that the requirements in CWI 05 Technical Requirements have been comprehensibly captured and presented in a format acceptable to the *Project Manager*
- d) ratify the methodology of OPO CCTV system design validation and verification;
- e) check calculations and testing to be undertaken as part of validation;
- f) identify any inherent functionality that is not directly linked to a requirement;
- g) identify any aspects of the OPO CCTV system design which the *Contractor* proposes to improve in a subsequent submission and how this will be managed via an auditable change control system;
- h) any other Design related issues; and
- i) be fully minuted, recording all proceedings, proposals, conclusions and actions.

Note: Platform Image System Design (Image Capture) and Platform Conceptual Design Validation (Image Capture) are to be reviewed in the Concept Design Report (Image Capture) Meetings specified in paragraph 06.5.11.2.

06.6.2 Design Review and Progress Meetings will be held at a minimum frequently of 4-weekly, unless agreed by the *Project Manager*.

06.6.3 Design Review and Progress Meetings will be held at the offices of the *Employer*, unless the *Project Manager* notifies the *Contractor* otherwise.

06.6.4 Design Review and Progress Meetings shall be chaired by the *Project Manager*.

06.6.5 The *Contractor* shall ensure that any Subcontractors and or Suppliers will attend Design Review and Progress Meeting as and when required to do so by the *Project Manager*.

06.6.7 The Employer will ensure that any relevant PDP's will attend the Design Review and Progress Meetings as required.

06.6.8 The agenda for the Design Review and Progress Meeting, conclusions reached in the meeting and actions for the *Project Manager* or the *Contractor* shall be recorded by the *Project Manager*.

06.7 Reliability Availability & Maintainability (RAM)

06.7.1 This section sets out the reliability, availability and maintainability (RAM) activities the *Contractor* shall carry out in order to provide Assurance to the *Employer* that all subsystems and components of the OPO CCTV System are designed, installed, tested, operated, and maintained to meet the OPO CCTV System RAM performance requirements.

Note: This section is applicable to the OPO CCTV System only. The *Contractor* does not have any obligations for the RAM performance of the OTC – Infrastructure Borne Equipment.

06.7.2 Responsibilities

06.7.2.1 The *Contractor* shall assess the reliability, availability and maintainability of the OPO CCTV System against quantitative requirements.

06.7.2.2 The *Contractor* shall achieve and demonstrate that the performance of the OPO CCTV System satisfies the RAM performance requirements set out in the SWI 05 Technical Requirements.

06.7.2.3 The *Contractor* shall be responsible for the production and timely submission for acceptance by the *Project Manager* of the RAM deliverables.

06.7.2.4 The *Contractor* shall be responsible for the performance of all the RAM related tests of the OPO CCTV System. The *Contractor* shall ensure that the testing is performed in a safe and effective manner and shall be responsible for the provision of necessary Assurance evidence.

06.7.3 Organisation

06.7.3.1 The *Contractor* shall ensure that its RAM resources are managed and controlled to ensure Good Industry Practice is followed and to ensure compliance with the *Employers* Standards, processes, rules and procedures.

06.7.4 RAM Management Plan

06.7.4.1 The *Contractor* shall prepare and implement a RAM Management Plan. The RAM management plan shall describe the processes and methods the *Contractor* will use to ensure the OPO CCTV System meets the RAM performance requirements set out in CWI 05 Technical Requirements and SWI 05 Technical Requirements.

06.7.4.2 The RAM Management Plan shall:

- a) describe the activities which shall be conducted to demonstrate how the reliability targets shall be met;
- b) state how confidence in the reliability will be developed through the OPO CCTV System Design, manufacture and test stages such that a high level of confidence in the reliability of the DTUP passenger train is achieved prior to introduction into service;
- c) show how all areas of the OPO CCTV System shall be subjected to RAM analysis based on internationally recognised methods;
- d) detail how the *Contractor* will comply with the RAM requirements of BS EN 50126 Railway Applications — The specification and demonstration of Reliability, Availability, Maintainability and Safety ;
- e) identify the process for demonstrating that the RAM requirements are met and the identity of the RAM methods to be used;

- f) describe how the documentation produced will satisfy the requirements of TfL Standard 1-212 Production of a reliability case;
- g) describe the organisation of the RAM team including the position within the Manufacturer's organisation for the Works;
- h) describe the management of all RAM-related interfaces, including those with PDP provided equipment;
- i) define the planned RAM assessments to demonstrate that the system RAM requirements are met by the OPO CCTV System Design;
- j) describe the management of *Subcontractors'* RAM requirements;
- k) describe the verification and validation of assessments, including data;
- l) state the process for validation of RAM requirements during manufacture, installation, commissioning and maintenance;
- m) list the schedule of deliverables for demonstration of reliability, availability and maintainability as described by the RAM Plan;
- n) be submitted to the *Project Manager* for Acceptance within 4 (four) months of from Order Commencement Date; and
- o) be regularly updated as the Works progresses (at least as frequently as prior to each Assurance Stage and Design Submission stage for the System Design of the OPO CCTV System) and re-submitted to the *Project Manager* for Acceptance.

06.7.4.3 The *Contractor* shall ensure that the RAM Management Plan describes any dependencies, links and influences with the other (relevant) Plans.

06.7.4.4 The *Contractor* shall verify the final reliability, availability and maintainability predictions as far as is practicable by testing after system design has been completed.

06.7.4.5 The *Contractor* shall demonstrate the reliability of all aspects of the OPO CCTV System under conditions representative of service conditions.

06.7.4.6 In the event that the RAM data indicates a shortfall in the required reliability of the OPO CCTV System the *Contractor* shall immediately undertake all necessary actions to ensure the cause of the deficiency is identified and remedial action taken to ensure the target figure is achieved. The *Contractor* shall, on all these occasions, notify the *Project Manager* and confirm how the shortfall has been satisfactorily resolved.

06.7.5 Reliability and Maintainability

06.7.5.1 The *Contractor* shall produce and maintain a Reliability Case in accordance with the requirements of TfL Standard S1-212 Production of a Reliability Case.

06.7.5.2 The *Contractor* shall make use of high level Failure Modes, Effects and Criticality Analysis (FMECA) and Fault Tree Analysis on each OPO CCTV System sub-system in accordance with Standard BS EN 50126 Railway Applications — The specification and demonstration of Reliability, Availability, Maintainability and Safety together with Reliability Block Diagram (RBD) and common cause failure analysis to model the OPO CCTV System.

06.7.5.3 The *Contractor* shall produce RAM analysis in order to show that the OPO CCTV System satisfies the RAM performance in accordance with the RAM management plan.

06.7.5.4 The *Contractor* shall manage and document the analysis, conclusions and proposals arising from reliability assessments to a level that demonstrates that the OPO CCTV System will meet the reliability requirements.

- 06.7.5.5 The *Contractor* shall ensure that the source of failure data used is stated in all reliability predictions.
- 06.7.5.6 The *Contractor* shall ensure that the reliability figures used in the prediction as part of the Reliability Case referred to in paragraph 06.7.5.1 are based on information obtained from suitable service experience or from applicable generic data inter alia, in order of preference:
- a) in-service data from similar equipment operating in the same environment as the Deep Tube Upgrade Programme;
 - b) test data, from related projects with similar equipment;
 - c) OEM data; and
 - d) generic databases, e.g. MIL-HDBK-217 F notice 2, PRISM, or similar.

06.8 Human Factors

- 06.8.1 The Design Management Plan shall include a Human Factors Strategy. The Human Factors Strategy shall:
- a) conform with stipulations and processes set out in the DTUP Human Factors Integration Plan (HFIP) (Appendix 06.1);
 - b) identify all methods of working to be used in order to meet the Human Factors for the works; and
 - c) detail the *Contractor's* compliance with each clause of the HFIP (subject to having obtained any derogations from the *Project Manager*).
- 06.8.2 The *Contractor* shall raise engineering issues that have Human Factors solutions to the *Project Manager* for inclusion into the DTUP Human Factors Issues Log (HFIL).
- 06.8.3 The *Contractor* shall attend Human Factors issues meetings, held by the *Project Manager*, in order to aid agreement and closure of raised issues.
- 06.8.4 The *Contractor* shall carry out Human Factors assessment and integration activities at all operations and maintenance facilities and customer environments impacted by the works to demonstrate compliance with the HFIP, in accordance with the Human Factors Strategy. Each Human Factors assessment shall consider the full life cycle of the works with reference to all:
- a) relevant personnel, including, the operators and maintainers along with other personnel, including security, breakdown and emergency services;
 - b) operation under Normal Conditions, Abnormal Conditions, Degraded Conditions and Emergency Conditions as defined in BS EN 50126 Railway Applications. The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS). Generic RAMS Process;
 - c) times of the day and night; and
 - d) climatic conditions.
- 06.8.5 The *Contractor* shall provide all necessary Human Factors evidence to the *Project Manager* to ensure progressive Assurance of the works.

06.9 Electromagnetic Compatibility (EMC)

- 06.9.1 The *Contractor* shall produce an Electromagnetic Compatibility Control Plan to the *Project Manager* for acceptance no later than eight (8) weeks from the Order Commencement Date.
- 06.9.2 The *Contractor* shall produce an Electromagnetic Compatibility Test Plan for acceptance by the *Project Manager* prior to the commencement of testing. The Electromagnetic Compatibility Test Plan shall cover apparatus compliance.
- 06.9.3 The *Contractor* shall produce an Electromagnetic Compatibility Test Report and Declaration of Conformity for acceptance by the *Project Manager*. The Electromagnetic Compatibility Test Report and Declaration of Conformity shall cover apparatus compliance.
- 06.9.4 The *Contractor* shall produce an Electromagnetic Compatibility / Radio Equipment Directive Technical File for acceptance by the *Project Manager*. The Electromagnetic Compatibility / Radio Equipment Directive Technical File shall address all apparatus and fixed installation aspects of the OPO CCTV System.
- 06.9.5 The *Contractor* shall provide all necessary Electromagnetic Compatibility evidence to the *Project Manager* to ensure progressive Assurance of the works.
- 06.9.6 For the avoidance of doubt the *Contractor* has no responsibility for the Electromagnetic Compatibility of the OTC – Infrastructure Borne Equipment as the system design responsibility resides with the Rolling Stock Manufacture.

06.10 Engineering Safety Management

- 06.10.1 The *Contractor* shall ensure that the *works* are safe, reliable and fit for purpose for operation in accordance with the primary purposes as set out in the Works Information and UK legislation.
- 06.10.2 The *Employer* will retain responsibility for the overall safety of the railway system. To discharge this responsibility information will be required from the *Contractor* from time to time, as described in the 'DTUP Engineering Safety Management Plan'. This information is expected to include, but not be limited to:
- a) show the commonality between engineering safety and reliability, availability and maintenance in line with BS EN 50126 Railway Applications. The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS). Generic RAMS Process;
 - b) show how Human Factors integration, together with the supporting analyses, has been accounted for within the system design;
 - c) show how cyber security has been addressed in the design;
 - d) show how electro-magnetic compatibility has been accounted for within the system design; and
 - e) show how the approach to the system design follows Good Industry Practice in respect to Engineering Safety Management and is compliant to UK legislation; e.g. The Railways and Other Guided Transport Systems (Safety) Regulations 2006 (as amended) (ROGS).
- 06.10.3 The *Contractor* shall provide all necessary information, technical support, attendance at meetings / workshops and cooperation to enable the *Project Manager* to fulfil their duties under the LUL Safety Management System and UK legislation. This will be inclusive of any *Employer*-appointed Independent Safety Advisor who may conduct

audits and reviews of the *Contractor's* development processes relevant to Engineering Safety Management.

06.11 Standards Management

- 06.11.1 The *Contractor* shall establish and implement a Standards management process that:
- a) includes the creation and maintenance of a matrix that lists all Standards that apply to the performance by the *Contractor* of its obligations under this Contract, including those specified in CWI 29 Standards and Guidance; and
 - b) enables evidence of compliance by the *Contractor's* with each of the Standards listed in the Standards Matrix to be provided as part of each Design Submission.
- 06.11.2 Where a specific clause/section of a Specified Standard is called up in a requirement in the CWI 05 - Technical Requirements, the *Contractor* shall submit in each Design Submission a clause-by-clause or section-by-section response to that clause/section of each Standard specified in CWI 29 Standards and Guidance as part of the response to that requirement.
- 06.11.3 Without prejudice to paragraph 06.10.2, for each British Standard and European Standard, the *Contractor* shall submit in each Design Submission a general "we comply" statement against each Applicable Standard. Any non-compliance with specific clauses shall be highlighted and justified. There is no requirement to submit responses against each clause in each British Standard and European Standard.

06.12 Requirements Management

- 06.12.1 The Design Management Plan shall include identification of the Requirements Management process that will be used by the *Contractor* to demonstrate compliance with the Works Information and (where necessary) generates more detailed lower level requirements to be used in the design.
- 06.12.2 The Design Management Plan shall set out how the *Contractor* will manage, validate and verify each of the Works Information requirements and any requirements that are developed within the scope of the *works*.

06.13 Configuration Management

- 06.13.1 The *Contractor* shall establish, implement and maintain a Configuration Management System consistent with the requirements of BS ISO 10007 "Quality management systems – Guidelines for configuration management". The *Contractor* shall apply configuration management to the Interfaces it has with Others.
- 06.13.2 The *Contractor* shall establish an appropriate configuration management methodology for the works and describe it in the Design Management Plan.

06.14 Obsolescence Management

- 06.14.1 The *Contractor* shall develop, implement and maintain a structured approach to the management and mitigation of obsolescence in all elements of the works.
- 06.14.2 The *Contractor* shall prepare an Obsolescence Strategy that complies with BS EN 62402:2007 'Obsolescence Management - Application Guide' and TfL Standard S1043 Obsolescence Management.
- 06.14.3 The *Contractor* shall submit an Obsolescence Strategy to the *Project Manager* for acceptance no later than twenty-six (26) weeks after the Order Commencement Date.

06.15 Verification and Validation

- 06.15.1 The *Contractor* shall support the *Project Manager* to produce the *Project Manager's* Verification Activity Plan.
- 06.15.2 The Verification Activity Plan will highlight the verification activities to be undertaken by the *Project Manager*, if any, to verify the Assurance evidence provided by the *Contractor* in accordance with TfL Standard S1538 Assurance.
- 06.15.3 The *Project Manager* will provide the *Contractor* with a copy of the Verification Activity Plan.
- 06.15.4 The *Project Manager* reserves the right to change the scope of the Verification Activity Plan or extent of verification activities and the level of assurance sought at any time, and in particular, in the event of:
- a) Assurance evidence provided being significantly inadequate;
 - b) a significant non-compliance affecting risk being identified;
 - c) a major change with significant risk implications;
 - d) a major incident; and
 - e) a degradation of supplier assurance and/or corrective action arrangements.
- 06.15.5 Where the *Project Manager* considers necessary this shall include seeking Assurance directly from lower levels in the assurance chain.
- 06.15.6 Any amendments to the Verification Activity Plan or the extent of verification shall be notified to the *Contractor* in Good Time.
- 06.15.7 The *Contractor* and *Subcontractors* shall co-operate with the verification activities outlined in the Verification Activity Plan.

06.16 Assurance

06.16.1 Introduction

- 06.16.1.1 The *Contractor* shall provide Assurance for all life cycle aspects of, and processes involved in, the Works including design, development, testing, service introduction, operation, modifications, maintenance and disposal. Assurance shall therefore cover, amongst other things, as a minimum, the following:
- a) design;
 - b) safety;
 - c) reliability;
 - d) quality;
 - e) testing;
 - f) interfaces;
 - g) maintenance;
 - h) maintainability;
 - i) operations;
 - j) human factors;
 - k) systems integration;
 - l) normal, abnormal, degraded and emergency conditions;

- m) obsolescence; and
- n) configuration management.

- 06.16.1.2 The *Contractor* shall implement, manage and maintain throughout the Assurance period a process of progressive Assurance in order to explicitly demonstrate to the *Project Manager* that the requirements set out in this Contract are being, and have been, fully met.
- 06.16.1.3 Assurance shall comprise coherent and convincing arguments supported by evidence which shall be documented in a way that is open to inspection.
- 06.16.1.4 The *Contractor* shall produce an Assurance Plan which shall describe the Manufacturer's intended Assurance activities.
- 06.16.1.5 The *Contractor* shall appoint an assurance manager no later than one (1) month after the Order Commencement Date. The assurance manager shall, on behalf of the *Contractor*, be responsible for ensuring that the Assurance activities, as set out in this Contract and the Assurance Plan are carried out correctly.
- 06.16.1.6 Assurance shall be consistent with, take account of, and demonstrate compliance with, all railway approval processes required by all Applicable Laws and Standards.

06.16.2 Validation and Verification Strategy

- 06.16.2.1 The Assurance Plan shall include a set of validation and verification strategies, defined by reference to the "V" life-cycle model referred to in paragraph 06.5.6 of CWI 06 which shall describe the means (whether by testing, certification or otherwise) by which the *Contractor* proposes to demonstrate to the *Project Manager* that a particular requirement (whether statutory, regulatory, contractual or otherwise) has been satisfied.
- 06.16.2.2 The verification and validation strategies shall include an OPO CCTV System verification process as a means of demonstrating compliance with all specified requirements and shall include compliance commentaries against the CWI 05 Technical Requirements and all Applicable Laws and Standards.
- 06.16.2.3 The *Contractor* shall progressively populate a download of the *Employer's* IBM Rational DOORS requirements database (which contains the Technical Specification) with responses which demonstrate how each requirement in the CWI 05 Technical Requirements has been satisfied. The format and process for sharing this will be agreed with the *Project Manager*.
- 06.16.2.4 The *Contractor* shall propose an OPO CCTV System Design validation process to the *Project Manager*, which shall include as a minimum:
- a) compliance with the requirements of this Contract, including, but not limited to:
 - (i) the CWI 05 Technical Requirements; and
 - (ii) all Applicable Laws and Standards.
 - b) the route to compliance, including:
 - (i) calculation;
 - (ii) relevant prior usage – fully detailed;
 - (iii) a proven comparable equivalent – fully detailed;
 - (iv) endurance tests; and

(v) type tests (including climatic where applicable).

06.16.3 The Assurance Plan

06.16.3.1 The *Contractor* shall:

- a) prepare a risk-based Assurance Plan; and
- b) within six (6) months of the Order Commencement Date, submit the Assurance Plan to the *Project Manager* for Acceptance.

06.16.3.2 The Assurance Plan shall contain:

- a) a description of all of the Assurance activities required;
- b) a description of the application of the Verification and Validation Strategies referred to in paragraph 06.15.2 above;
- c) a programme for the submission by the *Contractor* of the related Assurance information and/or documentation that will be submitted to the *Project Manager* for Acceptance. The *Contractor* shall ensure that the programme is structured to:
 - (i) allow regular intervals between the submission of information and/or documents to the *Project Manager*;
 - (ii) take into account any timeframes and/or approval periods specified in any Applicable Laws and Standards including conforming to the requirements of any relevant approvals;
 - (iii) be consistent with the Key Programme Dates; and
 - (iv) relate to the stages in the "V" life-cycle model prescribed by paragraph 06.15.2.2 above.
- d) details of how the *Contractor* will audit its own internal engineering management activities and those of any *Subcontractor*, as appropriate. The results of such audits shall be submitted to the *Project Manager* for Acceptance.
- e) details of how the *Contractor* will audit its own internal quality assurance activities and those of any *Subcontractor*, as appropriate. The results of such audits shall be submitted to the *Project Manager* for Acceptance; and
- f) roles and responsibilities of those people producing or managing Assurance.

06.16.3.3 The Assurance Plan shall demonstrate that the Assurance processes will be applied throughout the *Contractor's* supply chain including all relevant activities carried out by *Subcontractors* as appropriate.

06.16.3.4 The Assurance Plan shall include at least the following four (4) Assurance Submission stages, as a minimum:

- a) Assurance Stage 1 – System Design Completion (Incremental Acceptance);
- b) Assurance Stage 2 – Station Installation Design Completion (x 57 Stations);
- c) Assurance Stage 3 – Testing, Inspection and Commissioning Station Specific Works (x 57 Stations);

- (i) Initial
 - (ii) Final
 - d) Assurance Stage 4 – LUL Network Integration Testing (x 125 Platforms).
- 06.16.3.5 The Assurance Plan shall be updated by the *Contractor* as the *works* evolve, including as a minimum after each Assurance Stage. All revisions to the Assurance Plan shall be submitted to the *Project Manager* for Acceptance.
- 06.16.3.6 The *Contractor* shall not make a submission for Assurance Stage 2 until all necessary elements of OPO CCTV System Design have received Incremental Acceptance at Assurance Stage 1.
- 06.16.3.7 For all subsequent Assurance Stages the *Contractor* shall not make a submission for an Assurance Stage (which shall mean Acceptance of all relevant submissions to be made for that Stage in accordance with the Accepted Assurance Plan) until all the previous Assurance Stages have been Accepted for the relevant station, or platform as appropriate.
- 06.16.4 Assurance Stage 1 – System Design Completion**
- 06.16.4.1 The *Contractor* shall supply a suite of OPO CCTV System Design information as part of the Assurance Stage 1, in accordance with the Assurance Plan, to enable the *Project Manager* to have a full understanding of the design to demonstrate that the OPO CCTV System complies with the Works Information, which shall include, inter alia, the following:
- a) a reference to Design Submissions that were Accepted by the *Project Manager* in accordance with paragraph 06.5.7.1;
 - b) details of any amendments to the Technical Requirement previously Accepted by the *Project Manager*;
 - c) a full and unambiguous description of all external interfaces to the OPO CCTV System and all internal interfaces within the OPO CCTV System; and
 - d) the Technical Information.
- 06.16.4.2 The submissions shall reflect the stages the *Contractor* is proposing achieve incremental Acceptance of the overall system design, thereby, enabling the detailed design to commence on individual elements of the system ahead of the final Acceptance of the System Design.
- 06.16.4.3 The incremental stages shall be consistent with those identified in the Design Management Plan (paragraph 06.5.4.3 b) and the Testing, Inspection and Commissioning Strategy (CWI 07 Testing, Inspection and Commissioning).
- 06.16.5 Assurance Stage 2 – Station Installation Design Completion (x 57 Stations)**
- 06.16.5.1 The *Contractor* shall supply a suite of OPO CCTV System, OTC – Infrastructure Borne Equipment and Stopping Marker Installation Design information as part of the Assurance Stage 2, for each station in Accordance with the Assurance Plan, to enable the *Project Manager* to have a full understanding of the design to demonstrate that the Installation of the OPO CCTV System, OTC – Infrastructure Borne Equipment and Platform Stopping Markers complies with the Works Information, which shall include, inter alia, the following:
- a) a reference to Design Submissions that were Accepted by the *Project Manager* in accordance with paragraph 06.5.7.1;
 - b) details of any amendments to the Technical Requirement previously Accepted by the *Project Manager*; and
 - c) the Technical Information.

- 06.16.6 Assurance Stage 3 – Testing, Inspection and Commissioning Station Specific Works (x 57 Stations)**
- 06.16.6.1 Assurance Stage 3 is split into two stages:
- (a) Initial Testing, Inspection and Commissioning; and
 - (b) Final Testing, Inspection and Commissioning.
- 06.16.7 Initial Testing, Inspection and Commissioning Station Specific Works (x57 Stations)**
- 06.16.7.1 The *Contractor* shall supply a suite of information as part of the Assurance Stage 3(a) submission, in accordance with the Assurance Plan, to enable the *Project Manager* to have a full understanding of the Inspection, Testing and Commissioning of the OPO CCTV System, OTC – Infrastructure Borne Equipment and Platform Stopping Markers, for each platform and its compliance with the Works Information shall include, inter alia, the following:
- a) a summary of the results of the testing and inspection that has been carried out;
 - b) the Initial Commissioning Report for the OPO CCTV System as specified in CWI 05 – Technical Requirements;
 - c) the test results of the Transmission System as specified CWI 05 – Technical Requirements;
 - d) the test results for the OTC – Infrastructure Borne Equipment;
 - e) the verification survey for the Platform Stopping Markers in accordance with CWI 07 – Testing, Inspection and Commissioning; and
 - f) updated Technical Information.
- 06.16.8 Final Testing, Inspection and Commissioning Station Specific Works (x57 Stations)**
- 06.16.8.1 The *Contractor* shall supply a suite of information as part of the Assurance Stage 3(b) submission, in accordance with the Assurance Plan, to enable the *Project Manager* to have a full understanding of the Inspection, Testing and Commissioning of the OPO CCTV System, OTC – Infrastructure Borne Equipment and Platform Stopping Markers, for each platform and its compliance with the Works Information shall include, inter alia, the following:
- a) details of any reduction of the scope of the Final Testing, Inspection and Commission Requirement previously Accepted by the *Project Manager* in accordance with paragraph 07.3.5.3 of CWI 07 Testing, Inspection and Commissioning;
 - b) a summary of the results of the testing and inspection that has been carried out;
 - c) the final commissioning report for the OPO CCTV System as specified in CWI 05 Technical Requirements;
 - d) the test results of the Transmission System as specified in CWI 05 Technical Requirements;
 - e) the test results for the OTC – Infrastructure Borne Equipment; and
 - f) updated Technical Information.

06.16.9 Assurance Stage 4 – LUL Network Integration Testing (x 125 Platforms)

06.16.9.1 The *Contractor* shall supply a suite of information as part of the Assurance Stage 4 submission, in accordance with the Assurance Plan, to enable the *Project Manager* to have a full understanding of the LUL Network Integration of the OPO CCTV System, OTC – Infrastructure Borne Equipment and Platform Stopping Markers, for each platform and its compliance with the Works Information shall include, inter alia, the following:

- a) a summary of the results of the testing and inspection that has been carried out;
- b) the full handover pack for the OPO CCTV System as specified in CWI 05 Technical Requirements; and
- c) updated Technical Information.

Appendix 06.1 - Human Factors Integration Plan (HFIP)

See document titled: "*Appendix_06.1_-_Human_Factors_Integration_Plan_(HFIP)*"

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 07

Testing, Inspection and Commissioning

Table of Contents

07.1	Introduction	1
07.2	Glossary	1
07.3	OPO CCTV System Specific Testing Requirements	3
07.4	Testing, Inspection and Commissioning General	4
07.5	First Article Inspection, Type Tests, Routine Tests & Integration Testing	6
07.6	OTC – Infrastructure Bourne Works Specific Requirements	9
07.7	Platform Stopping Markers Specific Requirements	9
07.8	LUL Network Integration Testing	10
	Appendix 07.1 – Not Used	11

07.1 Introduction

07.1.1 This Common Works Information 07 sets out the testing, inspection and commissioning requirements for the *works* and shall be read in conjunction with CWI 05 Technical Requirements that includes specific technical requirements for Testing, Inspection and Commissioning.

07.2 Glossary

07.2.1 The terms and phrases defined in the below table apply to all elements of this CWI 07.

Term	Definition
Engineering Hours	this term applies to the running line and is described as being when traction current is switched off (as published in the Guide to Switching Traction Current On and Off subject to variance as published in an Engineering Notice) and trains are not running.
Final Testing and Commissioning	means the final testing and commissioning of the station specific works of the OPO CCTV System undertaken in accordance with Section 05.3.7.1.1 of CWI 05 Technical Requirements.
First Article Inspection (FAI)	inspections on all the works hardware components or assemblies at the point of assembly before mass production in accordance with the relevant Test Schedule, Testing, Inspection and Commissioning Strategy and the requirements of the Works Information as specified in paragraph 07.5.1.1
Initial Testing and Commissioning	means the initial testing and commissioning of the station specific works of the OPO CCTV System undertaken in accordance with Section 05.3.7.1.1 of CWI 05 Technical Requirements.
Integration Testing	tests to confirm that the interfaces between systems have been implemented correctly, both for function and performance as specified in paragraph 07.5.4.1.
Interface Tests	tests to confirm that the interfaces between systems have been implemented correctly, both for function and performance as specified in paragraph 07.5.4.2 a).
Lead PDP	has the meaning given to such term in Schedule 9 Implementation Works Terms – Systems Engineering, Integration and Interface Schedule
LUL Network Integration Testing	is undertaken to demonstrate compatibility of the new train with both existing and newly installed systems. LUL Network Integration Testing will be undertaken during Engineering Hours.
OTC – Infrastructure Borne Equipment	is the Off Train Communications (OTC) system equipment that is mounted on the infrastructure. The OTC – Infrastructure Borne Equipment is designed and free issued by the Rolling Stock Manufacturer. The OTC system provides the following functionality: <ul style="list-style-type: none"> a) Correct Side Door Enable (CSDE) functionality ensuring that the train doors can only be opened on the side adjacent to the platform and when the train is stopped within a defined tolerance of the Platform Stopping Position; and b) Two-way communications link to allow the transfer of data/commands to and from the train while berthed at the

	platform.
Participating PDP	has the meaning given to such term in Schedule 9 Implementation Works Terms – Systems Engineering, Integration and Interface Schedule
PDP (PDP)	means an organisation whether external to or internal within the Employer's organisation who is contracted to deliver any or all projects associated with the DTUP, including the <i>Contractor</i>
Performance Tests	tests to confirm that the integrated system is able to operate and meet the expected performance requirements and demonstrate the integrated system robustness as specified in paragraph 07.5.4.2 b).
Platform Datum Pin	has a datum pin provided on every platform by the <i>Employer</i> to facilitate setting out of the works.
Platform Stopping Markers	consist of rectangular plates bearing a series of chevron markings to facilitate a train operator stopping at the Platform Stopping Position.
Platform Stopping Position	<p>the Platform Stopping Position is the designated nominal stopping position for the New Train and is used as the datum to determine the position of the Train for design, installation, testing and commissioning of the OPO CCTV System.</p> <p>PSPs for each platform will be shown on drawings issued as part of the Works Information. The Platform Stopping Position is referenced from a datum point at the Platform Datum Pin at the leading end of the train in the direction of departure for a normal move. Dimensions on the drawings are +ve in the direction of travel of the train for a normal move; dimensions to features in the platform are therefore generally shown as -ve on the CAD drawings. Dimensions are taken along the centreline of the track, taken perpendicular from the track centreline.</p>
Rolling Stock Manufactures Test Track	the test facility provided by the Rolling Stock Manufacturer for integration testing of the train with equipment and systems provided by PDP's
Routine Testing	<p>tests undertaken on all production versions of the works hardware (including the components, sub-assembly or assembly comprised therein) to demonstrate:</p> <p>a) the hardware under test has at least the same performance as the same hardware that passed the Type Test; and</p> <p>b) the hardware under test has the exact same interfaces as the same hardware that passed the Type Test.</p> <p>as specified in paragraph 07.5.3.1. "Routine Test" shall be construed accordingly</p>
Schedule of Tests and Inspections	a schedule prepared by the <i>Contractor</i> detailing all test and inspections to be undertaken by the <i>Contractor</i> as specified in paragraph 07.4.2.
Station Specific Works	means the OPO CCTV System equipment installed at a station
Test Schedules	<p>schedules prepared by the Contractor documenting:</p> <p>a) The tests to be undertaken;</p>

	<ul style="list-style-type: none"> b) The procedure to be used; c) The instrumentation required; and d) The results and expected tolerances. as specified paragraph 07.4.6.
Testing and Inspection Programme	the programme produced by the <i>Contractor</i> detailing all test and inspections to be undertaken by the <i>Contractor</i> as specified in paragraph 07.4.2.
Testing, Inspection and Commissioning Strategy	the strategy prepared by the <i>Contractor</i> setting out the <i>Contractors</i> strategy for testing, inspection and commissioning and describing the nature of the tests and inspections, (specifications, methodology, pass/fail criteria) to be undertaken as specified in paragraph 07.4.2.
Train Borne Equipment	the components of the OPO CCTV System, within the <i>Contractor's</i> scope that are installed on the train
Type Testing	a test undertaken by the <i>Contractor</i> once for each hardware component, assembly and sub-assembly for which Type Tests are required to confirm that the item is fit for its intended purpose in the environmental conditions and complies with the applicable Standards and the Works Information as specified paragraph 07.5.1.1. "Type Test" shall be construed accordingly

07.3 OPO CCTV System Specific Testing Requirements

07.3.1 This section has been divided into the following sections:

- a) System level specific requirements;
- b) Station Specific Works specific requirements; and
- c) Train Borne Equipment specific requirements.

07.3.2 Specific Requirements - System Level

07.3.2.1 The Testing, Inspection and Commissioning Strategy shall demonstrate how the *Contractor* intends to achieve incremental approval of the overall system design, thereby, enabling the detailed design to commence on individual elements of the system ahead of the final acceptance of the system design.

07.3.2.2 The final acceptance of the system level design will be achieved on satisfactory completion of integration testing at the Rolling Stock Manufactures Test Track and testing of the overall system latency.

07.3.2.3 Testing of the overall system latency shall demonstrate that:

- a) the latency of the *Contractor's* works does not exceed the value specified in the CWI 05 - Technical Requirements;
- b) the latency of the elements of the system within the Rolling Stock Manufacturer's scope of supply does not exceed that specified in Appendix 05.5 of CWI 05 – Technical Requirements; and
- c) the latency of the overall system does not exceed the sum of the a) and b).

07.3.2.4 The overall system latency test shall be specified to capture the worst case latency of each element of the overall system including any buffering within cameras, or image processing elements.

07.3.3 Specific Requirements - Station Specific Works

07.3.3.1 The *Contractor* shall implement a comprehensive regime of inspection and testing of the station specific works of the OPO CCTV System in order to demonstrate to themselves and the *Project Manager* that the installation of the *works* is in compliance with the Works Information.

07.3.3.2 The functional testing and commissioning of the Station Specific Works of the OPO CCTV System shall be undertaken in two phases:

- a) Initial Testing and Commissioning on the completion of the installation of the Station Specific Works; and
- b) Final Testing and Commissioning not more than three (3) weeks prior to the LU Network Integration Testing for a specific station, or platform.

07.3.4 Initial Testing and Commissioning

07.3.4.1 Initial Testing and Commissioning shall be undertaken in accordance with Section 05.3.7.1.1 of CWI 05 - Technical Requirements.

07.3.5 Final Testing and Commissioning

07.3.5.1 Final Testing and Commissioning shall be undertaken in accordance with Section 05.3.7.1.1 of CWI 05 - Technical Requirements.

07.3.5.2 The *Contractor* may propose a reduced scope for the Final Testing and Commissioning on the basis that the systems condition monitoring, such as automated benchmark checking, eliminates the need for a specific test, or commissioning activity.

07.3.5.3 The *Contractor* shall support such proposal to reduce the scope of the Final Testing and Commissioning with appropriate evidence that specific condition monitoring functionality eliminates the need for a specific test, or commissioning activity. The *Project Manager* may accept the proposal at their sole discretion.

07.3.6 Specific Requirement – Train Bourne Equipment

07.3.6.1 All Train Bourne Equipment of the OPO CCTV System shall be subject to soak testing under normal operating conditions for a minimum of 72 hours after all the other applicable routine tests have been complete but prior to delivery.

07.4 Testing, Inspection and Commissioning General

07.4.1 The *Contractor* shall perform tests and inspections on the OPO CCTV System in accordance with the Testing, Inspection and Commissioning Strategy, Schedule of Tests and Inspections and the Testing and Inspection Programme in order to demonstrate to the *Project Manager* that the *works* are in compliance with the Works Information.

07.4.2 The *Contractor* provides the Testing, Inspection and Commissioning Strategy, the Schedule of Tests and Inspections and the Testing and Inspection Programme shall together describe and set out the nature of the tests and inspections, (specifications, methodology, pass/fail criteria) test and inspection location and date for each test and inspection and shall comprise the following parts:

- a) First Article Inspection (in accordance with Section 07.5.1);
- b) Type Tests (in accordance with Section 07.5.2);

- c) Routine Tests (in accordance with Section 07.5.3); and
 - d) Integration Testing (in accordance with Section 07.5.4).
- 07.4.3 Within four (4) months of the Order Commencement Date, the *Contractor* shall provide to the *Project Manager* for acceptance a draft Testing, Inspection and Commissioning Strategy, the draft Schedule of Tests and Inspections and draft Testing and Inspection Programme.
- 07.4.4 No later than two (2) months prior to the date on which the first Test is scheduled to be carried out, the *Contractor* shall provide to the *Project Manager* for acceptance the:
- a) Testing, Inspection and Commissioning Strategy;
 - b) Schedule of Tests and Inspections; and
 - c) Testing and Inspection Programme.
- respectively, setting out the proposed dates for satisfying the requirements of paragraph 07.4.1. The *Contractor* shall not commence any testing until the Schedule of Tests and Inspections has been accepted in accordance with paragraph 07.4.5 below.
- 07.4.5 Upon acceptance of such draft strategy, draft schedule and draft programme, they shall be the "Testing, Inspection and Commissioning Strategy", the "Schedule of Tests and Inspections" and the "Testing and Inspection Programme" respectively for the purposes of this Contract. The *Contractor* shall submit any subsequent change to any of these to the *Project Manager* for acceptance.
- 07.4.6 The *Contractor* shall compile Test Schedules for all tests to be performed. Test Schedules shall document:
- a) The tests to be undertaken;
 - b) The procedure to be used;
 - c) The instrumentation required; and
 - d) The results and expected tolerances.
- 07.4.7 The Test Schedules shall demonstrate that testing is carried out in accordance with the relevant and appropriate standards.
- 07.4.8 The Test Schedules shall be submitted not less than ten (10) Working Days before that test is due, to allow the *Project Manager* to satisfy them self that the tests are adequate in all respects.
- 07.4.9 All testing shall be carried out in accordance with test schedules accepted by the *Project Manager*.
- 07.4.10 The *Contractor* shall provide all necessary equipment, instrumentation and, if necessary premises for all of the tests.
- 07.4.11 All test equipment used for testing and inspection shall be calibrated in accordance with the quality assurance procedures specified in CWI 22 and shall comply with BS EN ISO 10012 "Measurement management systems - Requirements for measurement processes and measuring equipment". Tests undertaken using equipment without valid calibration shall be void.
- 07.4.12 The *Project Manager* shall have the right to attend any test whether at the premises of the *Contractor*, *Sub-Contractor*, or on *site*.
- 07.4.13 The *Project Manager* shall be invited to and given at least ten (10) Working Days written notice in advance, to witness all tests to be performed.
- 07.4.14 Should the *Project Manager* become aware that any test performed did not meet the Test Schedule requirements, the test shall be repeated at no further charge to the *Employer*, until it meets the Test Schedule requirements.
- 07.4.15 The *Contractor* shall send one copy of all test certificates to the *Project Manager* on

satisfactory completion of any such test within ten (10) Working Days being carried out.

07.4.16 In the event when any test indicating that any equipment, or parts of the Works does not meet the requirements of the Works Information, the *Contractor* shall take such remedial action as necessary, in accordance with the test and inspection programme already agreed with the *Project Manager* and shall repeat such tests in the presence of the *Project Manager*, and to the satisfaction of the *Project Manager*. The costs of such repeat test that are found to be due to the *Contractors* failure shall be borne solely by the *Contractor*.

07.4.17 If any tests are postponed by the *Contractor*, or delayed without reasonable prior notice and written agreement of the *Project Manager*, the *Contractor* shall pay any costs incurred by the *Employer* as a result of such delay or postponement such as travel or accommodation costs.

07.5 First Article Inspection, Type Tests, Routine Tests & Integration Testing

07.5.1 First Article Inspection

07.5.1.1 The *Contractor* shall complete First Article Inspections (FAI) on all the *works* hardware components or assemblies at the point of assembly before mass production in accordance with the relevant Test Schedule, Testing, Inspection and Commissioning Strategy and the requirements of the Works Information.

07.5.1.2 The *Contractor* shall supply all necessary drawings, specifications and measuring equipment to enable the *Project Manager* to witness and assess an FAI. The FAI shall include access to internal components where appropriate.

07.5.1.3 Where the *Contractor* proposes the reuse or redeployment of existing or similar Plant and Materials (which may or may not contain changes or modifications), the *Contractor* may submit to the *Project Manager* for acceptance a proposal that an FAI does not need to be undertaken.

07.5.1.4 The *Contractor* shall support any proposal not to carry out an FAI by submitting to the *Project Manager* for acceptance appropriate evidence of previous FAIs and confirmation that any changes made to the hardware do not invalidate the previous FAI.

07.5.2 Type Tests

07.5.2.1 A Type Test shall be successfully completed by the *Contractor* once for each hardware component, assembly and sub-assembly for which Type Tests are required to confirm that the item is fit for its intended purpose in the environmental conditions and complies with the applicable Standards and the Works Information.

07.5.2.2 Where the *Contractor* proposes the reuse or redeployment of existing or similar Plant and Materials the *Contractor* may submit a proposal that Type Testing is not required. Such a proposal shall include appropriate evidence of previous Type Tests and evidence that any changes made since do not undermine such evidence. Such a proposal shall be submitted for acceptance by the *Project Manager*.

07.5.3 Routine Test

07.5.3.1 The *Contractor* shall complete Routine Tests on all production versions of the *works* hardware (including the components, sub-assembly or assembly comprised therein).

07.5.3.2 The Routine Testing shall be structured so as to demonstrate:

- a) the hardware under test has at least the same performance as the same hardware that passed the Type Test;
- b) the hardware under test has the exact same interfaces as the same hardware that passed the Type Test;
- c) the hardware under test has at most the same power consumption and cooling requirements as the same hardware that passed the Type Test; and
- d) the hardware under test is reliable and will not fail shortly after being installed.

07.5.4 Integration Testing

07.5.4.1 The *Contractor* shall carry out Integration Testing to prove the compatibility of the *works* with:

- a) all Interfaces identified in Schedule 9 Implementation Works Terms – Systems Engineering, Integration and Interface Schedule, Appendix 1 (Indicative Interface Matrix); and
- b) any additional Interfaces established during the design of the *works*.

07.5.4.2 Integration Testing shall consist of the following types of tests:

- a) Interface Tests: Interface tests shall confirm that the interfaces between systems have been implemented correctly, both for function and performance. The corresponding test procedures shall be written to demonstrate successful functionality of all interfacing systems across an interface boundary; and
- b) Performance Tests: Performance tests shall confirm that the integrated system is able to operate and meet the expected performance requirements and demonstrate the integrated system robustness.

07.5.4.3 All modes of operation (including system redundancy) shall be tested to the fullest extent possible.

07.5.4.4 Each Integration Test identified within the Schedule of Tests and Inspections will be assigned by the *Employer* to a Lead PDP.

07.5.4.5 Where the *Contractor* is Lead PDP it shall propose a draft test programme that defines the sequence and dates for each test stage for each Interface and the *Employer* shall procure that each other Lead PDP complies with the same obligation. Where the *Contractor* is Lead PDP, the *Employer* shall procure that the relevant Participating PDPs shall review the draft test programme and reach agreement. In the event of any disagreement, the *Project Manager* will determine the test programme.

07.5.4.6 The *Employer* shall procure that:

- a) each Lead PDP will produce a test procedure for each Integration Test identified within the Schedule of Tests and Inspections; and
- b) an accompanying statement will be signed by the Lead PDP and each relevant Participating PDP to confirm that the appropriate information has been provided and that they have jointly reviewed and agreed the test procedure prior to the commencement of each Integration Test.

07.5.4.7 Where the *Contractor* acts as a Lead PDP it shall appoint a test manager for the duration of Integration Testing, and the *Employer* shall procure the same in relation to the other PDPs.

07.5.4.8 Where the *Contractor* is Lead PDP, the *Employer* shall procure that each relevant Participating PDPs shall:

- a) ensure that its test manager is responsible for the scheduling of the resources under their charge;

- b) liaise with the designated Lead PDP for the conduct of the tests and re-tests and co-ordinate with the *Contractor* for the commissioning and decommissioning of equipment at the Rolling Stock Manufactures Test Track facilities;
 - c) ensure that the testing activities under their charge are supported by adequate logistics capability, inclusive of initial and sustaining requirements for spares and consumables; and
 - d) ensure that the systems and equipment under their charge do not interfere with the normal operation of the existing equipment in the surrounding environment.
- 07.5.4.9 Where the *Contractor* is Lead PDP for an Integration Test, the *Contractor* shall be responsible for compiling and submitting the respective test results for that Integration Test and reports to the *Project Manager* upon completion of each relevant Integration Test as specified in the test procedures.
- 07.5.4.10 The *Employer* shall be responsible for the overall management of the Integration Test programme. The *Project Manager* shall, in consultation with all relevant PDPs, further develop this programme with detailed tests.
- 07.5.4.11 The *Contractor* shall ensure those of its representatives involved in Integration Testing understand the roles and responsibilities of each PDP so that the activities can be carried out safely, efficiently and effectively. If, during the activities, the *Project Manager* considers that the representatives involved in Integration Testing are not properly integrated or coordinated, then the *Contractor* shall comply with any instructions of the *Project Manager* to rectify such issues.
- 07.5.4.12 In the event of a disagreement between PDPs on the production of the Schedule of Tests and Inspections and procedures, the Lead PDP shall refer the matter to the *Project Manager* for determination and such determination shall be final and binding.
- 07.5.4.13 Where the *Contractor* is Lead PDP for an Integration Test, the *Contractor* shall:
- a) ensure the readiness of resources and logistics to be provided for the relevant Integration Test is adequate and coordinated with other PDPs, to ensure their readiness for the tests; and
 - b) take the lead in resolving any interface issues that arise from the test. The *Contractor* shall provide recommendations on all corrective measures required and submit any resolutions to the *Employer* for acceptance.
- 07.5.4.14 Where the *Contractor* is a Participating PDP, the *Contractor* shall provide problem analysis and troubleshooting support to the Lead PDP with respect to the scope of works for which the Lead PDP is responsible.
- 07.5.4.15 Where the *Contractor* is Lead PDP, it shall liaise and agree the Schedule of Tests and Inspections with the Participating PDPs. The contents of the Schedule of Tests and Inspections shall include:
- a) the process for testing;
 - b) a brief system description, the inter-dependency and interaction of the PDP's subsystems and with systems supplied by other parties;
 - c) roles and responsibilities during each Integration Testing;
 - d) the systems and equipment required from other PDPs to support Integration Testing;
 - e) the plan for verifying the integrity of the test equipment and arrangements;
 - f) the schedule of tests to be conducted;
 - g) an equipment delivery and installation schedule and programme which shall include the proposed scope of supply for each PDP;

- h) configuration data for hardware, software and firmware test specifications to be used;
- i) the prerequisites for each Integration Test including state of the system, prerequisite tests and criteria;
- j) configuration of equipment;
- k) degraded modes to be tested;
- l) clearly defined pass/fail criteria; and
- m) actions and responsibilities in the event of failure.

07.5.4.16 All Integration Test specifications and results shall be provided by the *Contractor* to the *Project Manager* for acceptance. Following acceptance, the *Contractor* shall provide PDPs with test specifications and test results of all Integration Testing to which their systems and equipment interface.

07.5.4.17 The *Contractor* shall participate in the tests and operate their system and equipment whenever necessary in all Integration Testing, including attendance at Integration Testing led by Lead PDPs other than the *Contractor*.

07.5.4.18 Throughout the period of Integration Testing, the *Contractor* shall submit a weekly test progress report to the *Project Manager*, reporting the progress status of the respective tests and any updates to the schedule.

07.5.4.19 In relation to Integration Testing where it is the Lead PDP, the *Contractor* shall:

- a) hold weekly meetings at the agreed Rolling Stock Manufactures Test Track office to review progress and test progress reports; and
- b) hold test sign-off meetings after the completion of an Integration Test at which all test procedures, test results and findings, and outstanding non-conformance listing, shall be reviewed and examined. Test sign-off meetings shall be chaired by the *Contractor* and be attended by the Lead PDP and Participating PDPs.

07.6 OTC – Infrastructure Bourne Works Specific Requirements

07.6.1 Testing and commissioning of the Station Specific Works for the OTC – Infrastructure Bourne Equipment shall in accordance with the technical specification provided by the Rolling Stock Manufacture. Testing and Commissioning is undertaken in two phases:

- a) Initial Testing on the completion of the installation of the OTC – Infrastructure Bourne Equipment; and
- b) Final Testing and commissioning not more than three (3) weeks prior to LUL Network Integration Testing for a specific station, or platform.

07.7 Platform Stopping Markers Specific Requirements

07.7.1 Testing and commissioning of the Platform Stopping Markers shall consist of a verification survey in accordance with the technical specification provided by the *Project Manager* to confirm that the Platform Stopping Markers have been installed in the correct relationship to the Platform Datum Pin to within the specified tolerances. For the avoidance of doubt testing and commissioning of the Platform Stopping Markers is undertaken in a single phase.

07.8 LUL Network Integration Testing

07.8.1 LUL Network Integration Testing will be undertaken during Engineering Hours to

demonstrate compatibility of the new train with both existing and newly installed systems. The *Employer* leads and coordinates LUL Network Integration Testing.

07.8.2 Integration Testing includes the final testing and acceptance of OPO CCTV Station Specific works, OTC – Infrastructure Borne Equipment and Platform Stopping Markers.

07.8.3 The *Contractor* leads OPO CCTV Station Specific Works Integration Testing.

Appendix 07.1

Not Used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 08

Completion

Table of Contents

08.1	General	1
08.2	Glossary	1
08.3	General Completion Requirements	1
Appendix 08.1	Not Used	2

08.1 General

08.1.1 This section further defines the *Employer's* requirements with regards to Completion.

08.2 Glossary

08.2.1 The following terms apply to this CWI 08.

Term	Definition
N/A	N/A

08.3 General Completion Requirements

08.3.1 Achieving Completion shall only occur when each of the following requirements are satisfied by the *Contractor*:

- a) all relevant documents relating to the *works*, including technical Information, and maintenance information, that are due to have been prepared by the date of Completion have been delivered by the *Contractor* to the *Project Manager* and where required have been accepted by the *Project Manager*;
- b) all testing set out in the testing & commissioning strategy as being required to have been completed by the date of Completion, has been carried out in accordance with the relevant test procedures and all tests have been accepted by the *Project Manager*;
- c) all training that the *Contractor* is required to have carried out in relation to the *works* by the date of Completion has been carried out in accordance with the Works Information;
- d) all reviews required to have been undertaken by the date of Completion (as set out in the latest Accepted Programme) have been held and have been passed by the *Contractor*;
- e) the insurances required to be taken out by the *Contractor* in accordance with these Implementation Works Terms have been taken out and are valid;
- f) all relevant approvals required to have been obtained for Completion have been obtained and are in force and effect; and
- g) all software relevant to the Completion have been supplied by the *Contractor* to the *Project Manager* and all Escrow Materials to be placed in escrow have been placed in escrow with the Escrow Agent.

Appendix 08.1

Not used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 09

Training

Table of Contents

09.1	General	1
09.2	Glossary	1
09.3	Training	2
09.4	Training Approach	4
09.5	Training Strategy	5
09.6	Training Programme	5
09.7	Training Tools & Equipment	6
09.8	Training Acceptability	6
09.9	LUL Safety Training	7
Appendix 09.1 – Process for the Validation of Training		8

09.1 General

- 09.1.1 This Common Works Information sets out the training and associated activities that the *Contractor* provides for the OPO CCTV System. It does not cover the support provided to the Rolling Stock Manufacturer relating to the Train Borne Equipment to enable the Rolling Stock Manufacturer to provide comprehensive training.

09.2 Glossary

Term	Definitions
End-User	means the <i>Employer's</i> operational and maintenance staff involved in the day-to-day running of the relevant Line including the <i>Employer's</i> training staff
LUL Network Integration Testing	LUL Network Integration Testing is undertaken to demonstrate compatibility of the new train with both existing and newly installed systems. LUL Network Integration Testing will be undertaken during Engineering Hours.
OTC - Infrastructure Borne Equipment	is the OTC System equipment that is mounted on the infrastructure. The OTC – Infrastructure Borne Equipment is designed and free issued by the Rolling Stock Manufacture. The OTC System provides the following functionality: <ul style="list-style-type: none"> a) Correct Side Door Enable (CSDE) functionality ensuring that the train doors can only be opened on the side adjacent to the platform and when the train is stopped within a defined tolerance of the Platform Stopping Position; and b) Two-way communications link to allow the transfer of data/commands to and from the train while berthed at the platform.
Platform Stopping Markers	Platform Stopping Markers consist of rectangular plates bearing a series of chevron markings to facilitate a train operator stopping at the platform stopping position.
Train Borne Equipment	the components of the OPO CCTV System, within the Contractor's scope that are installed on the train
Training Gap Analysis	the process used to identify the gap that exists (typically defined in terms of knowledge and skill) between existing competence levels (involving the baseline tasks currently completed on existing assets/systems) and the additional competence levels required for the new assets/systems (involving the predictive tasks that will be completed on the new assets/systems)
Training Needs Analysis	the process(es) used to identify the current or anticipated gaps in knowledge, skills and abilities at an individual, team or organisational level that includes Training Predictive Task Analysis, Training Gap Analysis.

Training Predictive Task Analysis	an analysis of any or all the assets, systems equipment or functionality under consideration to determine the envisaged tasks (including operational and maintenance tasks) that will need to be performed, together with their associated performance standards
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09.3 Training

- 09.3.1 No training is required in relation to the installation of the Platform Stopping Markers and OTC Infrastructure Borne Equipment.
- 09.3.2 The *Contractor* adheres to the following principles in the delivery of training for the OPO CCTV System:
- a) comprehensive Training Needs Analysis shall be completed by the *Contractor* and used to underpin the design, development, delivery and evaluation of all training;
 - b) the *Contractor* assures and validates all training and associated documentation;
 - c) no safety risk, at either a system or a personal level, will be introduced through a lack of, or through the inappropriate provision of training; and
 - d) training shall be appropriately designed, developed and delivered so as to ensure that no failure or delay will be introduced on the operational railway through a lack of, or through the inappropriate provision of, training.
- 09.3.3 The *Contractor* provides training to the breadth and depth required to enable the End-Users and project staff to acquire the relevant knowledge and skills to safely and efficiently oversee the implementation, operate and maintain the OPO CCTV System.
- 09.3.4 A "train-the-trainer" approach shall be adopted by the *Contractor* except as otherwise set out in the Works Information. Where, however, the *Employer* deems it more expedient, either in relation to the numbers involved or to any such consideration, the *Contractor* shall also directly train any End-Users and project staff identified by the *Project Manager*. In either case the maximum number training courses shall be as set out in the SWI 09 – Training.
- 09.3.5 The *Contractor* completes the required training analysis, design, development, validation, delivery and evaluation in accordance with recognised Good Industry Practice within the railway industry, such as that outlined within the document entitled, 'Good Practice Guide on Competence Development' (Rail Safety and Standards Board Limited).
- 09.3.6 Unless otherwise agreed between the *Project Manager* and *Contractor*, training delivery venues shall be at *Employer* facilities within the geographical area of the LUL Network. Where any training can only reasonably be provided by the *Contractor* at a location outside London, the *Employer* shall meet the subsistence costs of the *Employer's* staff to be trained.
- 09.3.7 The *Contractor* provides all written and oral communication relating to training, including that associated with training delivery and with the clarification of training-related queries using a person (or persons) proficient in the English language.

- 09.3.8 The *Contractor* shall use a mix of both traditional and technology-based training approaches to deliver the training. Traditional training approaches shall include both training-room-based and hands-on practical exposure to the operation and maintenance of the supplied asset(s), system(s), equipment and functionality. Technology-based training approaches shall include e-learning and simulation/emulation.
- 09.3.9 To provide an optimal solution for training delivery during the lifecycle of the OPO CCTV System the *Contractor* provides details in the training strategy of the approach the *Contractor* recommends for the most appropriate utilisation of technology (such as computer-based training, simulation, emulation and augmented reality applications).
- 09.3.10 The *Contractor* provides training in relation to the entire cyber security programme and cyber security procedures for OPO CCTV system, as well as the technical features and implementation details of the cyber security solutions.
- 09.3.11 The *Contractor* provides to the *Project Manager* and Others all necessary information, documentation and support required (including timely access to technical experts) to develop training (including Defect diagnosis and rectification training) in relation to system interfaces (including the overarching integrated railway system Interfaces) with the OPO CCTV System.
- 09.3.12 All training shall be accompanied by a full suite of validated and assured documentation accepted by the *Project Manager*, including:
- a) technical information, including manuals (providing detailed instructions for the operation/maintenance of the asset(s), system(s) training tools and equipment being supplied) applicable to the training being provided by the *Contractor*, and
 - b) training materials, including training specifications, detailed trainers' notes, presentation materials (e.g. slides, models etc.), formative and summative assessments and trainee material (e.g. handbooks).
- 09.3.13 The *Contractor* provides training and updated documentation (such as system, operator and maintainer manuals) that have been accepted by the *Project Manager* in relation to any changes that are introduced which affect any aspect of the OPO CCTV System. Such training shall be provided, up to Completion, to *Employer's* staff sufficiently in advance of the introduction of the changes concerned on the operational railway in order to enable the *Employer* to complete all associated operational readiness activities and cascade the training to all affected groups.
- 09.3.14 In order to facilitate the development of technology-based training (such as simulation or computer based training) by the *Employer* and others, the *Contractor* provides all required technical information, including documentation such as illustrations, schematics, display screen captures, manuals and design information relating to the design parameters, functionality, operation and maintenance of the OPO CCTV System.
- 09.3.15 The *Employer* may, at its discretion, place End-Users or project staff in a shadowing capacity alongside those of the *Contractor* as part of the *Employer's* staff familiarisation and training of the OPO CCTV System.
- 09.3.16 The *Contractor* provides training in relation to the control, configuration, update, upload and testing of software and associated data.

- 09.3.17 The *Contractor* delivers training that provides full coverage of the skills and disciplines required to accomplish the prevention, diagnosis and rectification of software faults and software error conditions occurring in the OPO CCTV System components. Such training shall be supported by the provision of appropriate diagnostic aids; such as fault diagnosis decision trees.
- 09.3.18 The *Contractor* provides comprehensive training in the methods and processes to be used to apply and roll-back software patches, software updates and security updates.

09.4 Training Approach

- 09.4.1 The *Contractor* provides training, via a 'direct' approach (rather than 'train-the-trainer') to address the needs of the following groups of the Employer's staff:
- a) project staff involved in design and assurance/approval activities; and
 - b) project staff involved in testing and commissioning activities.
- 09.4.2 The *Contractor* completes Training Needs Analysis and provides a separate training course or separate training courses (as determined by the Training Needs Analysis) for each group.
- 09.4.3 The *Contractor* provides sufficient training and documentation to ensure that the trainees on each course:
- a) acquire all relevant knowledge and skill in relation to the design and assurance / approval of the supplied asset(s), system(s) and equipment and materials, including all facets relating to the function, malfunction (including the range and ramification of potential fault and failure conditions), operation and use of the OPO CCTV system equipment and materials; and
 - b) acquire all relevant knowledge and skill in relation to the completion of tasks (as determined by Training Needs Analysis) associated with the testing and commissioning of the supplied Train Borne Equipment for the OPO CCTV System.
- 09.4.4 The *Contractor* provides training that shall incorporate all the content necessary to meet the training needs of the Employer's staff concerned, including:
- a) a system overview and other such elements that may be common to more than one training module/course;
 - b) details of the functionality of the OPO CCTV System;
 - c) analysis and interpretation of OPO CCTV System logs and records;
 - d) the use of all supplied tools and equipment to complete diagnostic and analysis activities;
 - e) line-specific content;
 - f) being designed, developed and delivered to ensure the *Employer's* staff involved in the testing and commissioning activities receive training in advance of LUL Network Integration Testing;
 - g) being delivered in accordance with the Accepted Programme; and
 - h) being updated on a regular basis such that, at all times, the training materials accurately reflect all changes introduced that affect any aspect of the testing and

commissioning strategy and plans, including relevant line-specific protocols, relating to the Equipment and Materials and functionality. Such updated training materials shall be submitted by the *Contractor* for acceptance by the *Project Manager* and made available to the *Project Manager* upon request.

09.4.5 The number of times that this course is delivered by the *Contractor* is set out in the Specific Works Information.

09.5 Training Strategy

09.5.1 The *Contractor* submits a training strategy for acceptance by the *Project Manager*. The first iteration of the training strategy shall be submitted within fifty two (52) weeks of the Order Commencement Date.

09.5.2 The *Contractor* ensures the training strategy:

- a) outlines the approach that will be adopted for the completion of Training Needs Analysis for each End-User group (including Training Predictive Task Analysis, Training Gap Analysis), training design, training development, training validation, training delivery, training evaluation and competence assessment;
- b) provides an overview of the training courses to be provided, together with their anticipated durations and the equipment, tools and facilities required for their delivery;
- c) lists the systems/equipment and procedures/processes on which training will be provided;
- d) outlines the approach that will be adopted to ensure that the *Contractor's* representatives leading the analysis, design, development, validation, delivery and evaluation of training are competent;
- e) outlines the approach that will be adopted for the maintenance of training records; and
- f) outlines the approach to the training validation and assurance in accordance with the process given in Process for the Validation of Training provided in Appendix 09.1.

09.6 Training Programme

09.6.1 The *Contractor* submits a training programme for acceptance by the *Project Manager* at the same time that the training strategy is submitted. The training programme is expected to be a specific extract from the Accepted Programme. The training programme shall be updated and re-submitted for acceptance eight (8) weeks prior to the first scheduled training course.

09.6.2 The *Contractor* ensures the training programme details the timing of all training in accordance with the following requirements:

- a) each training activity shall be listed individually; such activities shall include the following: training analysis (including Training Predictive Task Analysis, Training Gap), training development and *Contractor* assurance of the training materials, *Project Manager* acceptance of the training materials, update (if required) and re-submission of the training materials to the *Project Manager* for acceptance, training delivery, training evaluation and, competence assessments;
- b) milestones for the availability of the validated/assured documentation required to

develop training (such as operator manuals and system and maintainer manuals) shall be shown;

- c) key dates (including the earliest/latest start dates) shall be shown;
- d) the critical path for training-related activities shall be highlighted (if relevant);
- e) training-related activity durations shall be detailed;
- f) key logic links to related activities shall be shown;
- g) all training activities shall be linked to agreed high-level programme milestones to facilitate the tracking of training activities at a programme level; and
- h) the lead times required by the *Employer's* internal training programme, as set out in the Works Information, for the cascade of the training shall be shown and adequate provision (within the Accepted Programme) shall be made to accommodate these.

09.6.3 The *Contractor* details all timescales and makes programme provision in relation to training in the training programme as follows:

- a) training strategy: preparation and submission for acceptance by the *Project Manager*, and
- b) training preparation and submission of training material for acceptance by the *Project Manager*.

09.7 Training Tools & Equipment

09.7.1 The *Contractor* supplies all tools, equipment and software necessary for the delivery of the training courses in the manner as set out in the training materials.

09.7.2 The *Contractor* provides training in the set-up, use and maintenance of all tools and equipment and materials, including all software, diagnostic and analysis tools and equipment and materials provided to support training.

09.7.3 The *Contractor* provides training in the use and operation of *Contractor*-provided special tools supplied to support maintenance.

09.7.4 The *Contractor* provides training in the calibration and adjustment of *Contractor*-provided special tools.

09.7.5 The *Contractor* provides training for the configuration and use of any software, diagnostic, or corrective tools required to accomplish fault diagnosis, fault rectification and system management.

09.8 Training Acceptability

09.8.1 The *Project Manager* is allowed to witness the delivery of each training course (such witnessing shall not be included in the number of participants).

09.8.2 The acceptability of each of the provided training courses shall be assessed by the *Project Manager* based on delivery of the training course to the End-Users or project staff, including the delivery of training evaluation and the delivery of any required competence assessments.

09.8.3 If the *Project Manager* determines that a training course is not acceptable the *Contractor*

shall revise, as appropriate, the training material and training equipment, the course delivery and the competency assessments to address the deficiencies identified by the *Project Manager*. The complete training course will then be re-assessed by the *Project Manager*.

09.8.4 Following assessment by the *Project Manager* of any training course, should any alteration be required to the training course or training materials in light of training approach, in-service operations or maintenance experience, the *Contractor* completes any necessary analysis and provides updated training materials.

09.8.5 The *Contractor* provides all necessary support to ensure that the *Employer's* training staff acquire all relevant knowledge and skill associated with the changes concerned in an appropriate manner.

09.9 LUL Safety Training

09.9.1 To safely access LUL Network to undertake the *works* the *Contractor's*, and Subcontractor's, staff are required to hold the appropriate individual certification in accordance with the relevant TfL Standards or LUL Rule Book(s).

09.9.2 The *Contractor* shall ensure that the personnel have all the relevant safety training and certification required to work on LUL Network as per Works Information and best practice and, where an exception exists, then communication shall be made with the *Project Manager* before the commencement of work, or start of contract.

09.9.3 Training Needs

09.9.3.1 Following submission of training strategy, the *Contractor* shall submit a quarterly forecast detailing its training needs for the ensuing year. The *Contractor* shall also provide the actual training figures for the last quarter compared with forecast. These figures will be verified by the *Employer*. This forecast shall be submitted in the template to be provided by the *Project Manager*.

09.9.4 Payment for Courses

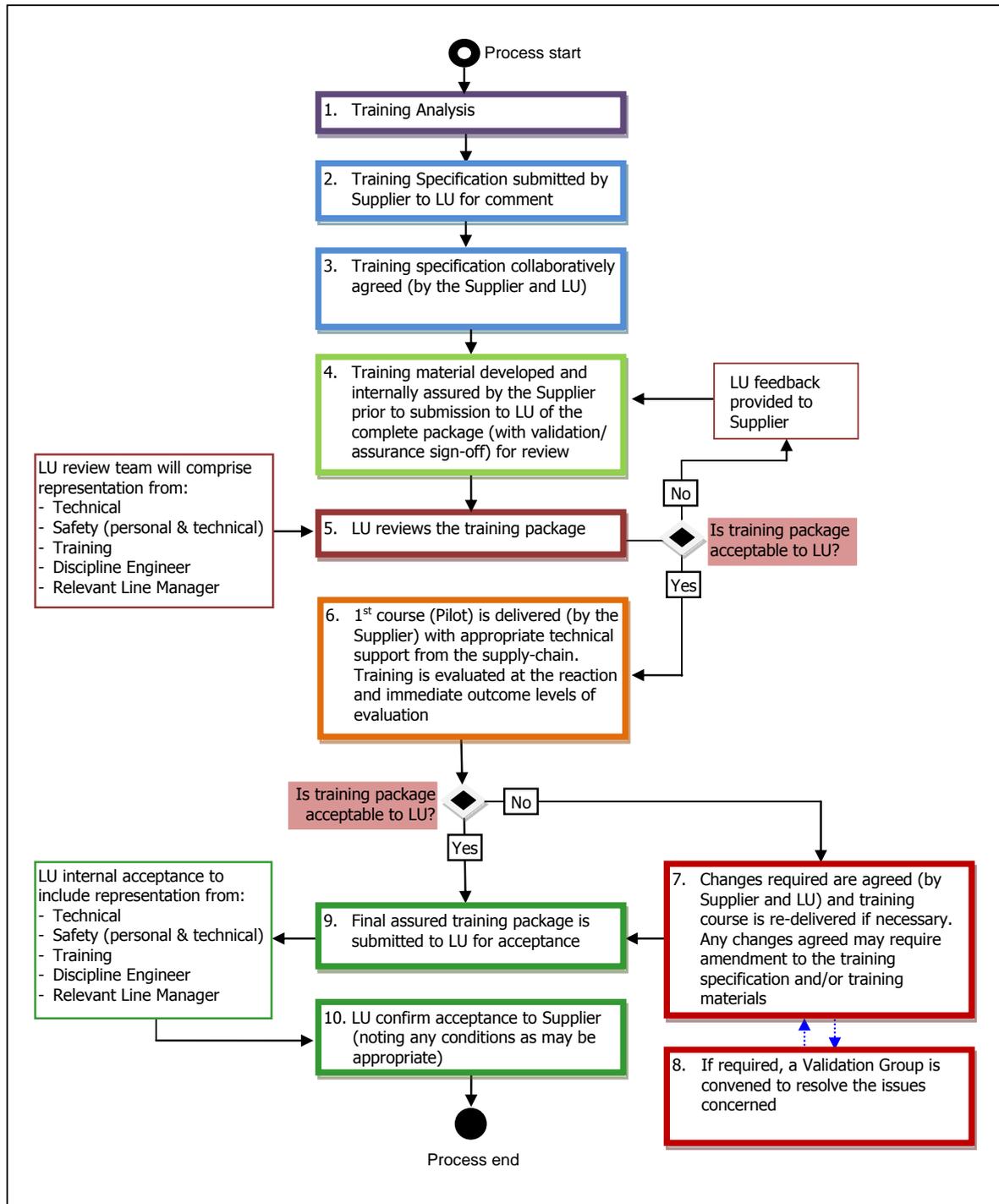
09.9.4.1 The *Employer* shall pay for all LUL safety training required by the *Contractor*, and its Subcontractors, to carry out the *works*. Any additional training required by the *Contractor*, and its Subcontractors, shall be at the *Contractor's* cost unless agreed otherwise by the *Project Manager*.

09.9.4.2 The *Contractor* shall be liable for all costs where;

- a) a cancellation is made without written confirmation being received; or
- b) a cancellation is made within fourteen (14 days) of the course commencement date; or
- c) a delegate does not show up for a course (non-attendance).

Appendix 09.1 - Process for the Validation of Training

“LU” to be taken as *Employer* and “Supplier” to be taken as *Contractor*.



Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 10

Cyber Security

Table of Contents

10.1	General	1
10.2	Glossary	1
10.3	Security Logging and Monitoring	1
Appendix 10.1 – Not Used		2

10.1 General

- 10.1.1 This document should be read in conjunction with the General Terms, Schedule 13 – Cyber Security.

10.2 Glossary

- 10.2.1 The following terms are applicable to this CWI 10:

Term	Definition
N/A	N/A

10.3 Security Logging and Monitoring

- 10.3.1 The *Contractor* shall maintain a log of:

- (a) all instances of *Contractor* Personnel accessing personal data;
- (b) all system recipient, *Employer* Personnel and *Contractor* Personnel logon attempts, successful and failed, to the Systems or any elements of the OPO CCTV System requiring authentication;
- (c) all actions taken by system recipients, *Employer* Personnel or *Contractor* Personnel with administrative privileges;
- (d) all instances of accounts being created for system recipients, *Employer* Personnel or *Contractor* Personnel and their relevant privileges;
- (e) all records of formal staff induction or certification required by *Contractor* Personnel to operate systems and handle TfL Restricted data (where required);
- (f) all instances of accounts for system recipients, *Employer* Personnel, or *Contractor* Personnel being deleted;
- (g) *Contractor* Personnel system access group memberships in relation to relevant System Assets;
- (h) system recipient and group privilege changes against each of the system resources;
- (i) unauthorised use of input and output devices and removable media; and
- (j) all access to log files and audit systems.

- 10.3.2 The logs required above must be raw logs, which are provided in a structured text format and the schema for such logs will need to be provided.

Appendix 10.1

Not Used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 11

Information Management

Table of Contents

11.1	General	1
11.2	Glossary	1
11.3	Building Information Modelling Responsibilities	3
11.4	Building Information Modelling Process	3
11.5	Building Information Modelling Coordination Process	4
11.6	Building Information Modelling Submission Procedures	4
Appendix 11.1 – Employers Information Requirements (EIR)		5
Appendix 11.2 – Master Information Delivery Plan (MiDP) Template		6
Appendix 11.3 – BIM Protocol		7
Appendix 11.4 – P1x Protocol – IT Assessment Template		8

11.1 General

11.1.1 This Common Works Information 11 (CWI 11) describes the requirements that the *Contractor* shall comply with in Providing the Works.

11.2 Glossary

The terms and phrases defined in the below table are applicable to this CWI 11.

Term	Definition
Building Information Modelling (BIM)	The process of designing, constructing or operating a building or infrastructure asset using electronic object orientated information.
BIM Execution Plan (BEP)	A plan, provided by the <i>Contractor</i> detailing how the <i>Contractor</i> will comply with requirements as set out in the Employer's Information Requirements.
Common Data Environment (CDE)	The agreed solution for the production, use and management of Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s), as set out in the EIR, BEP and MIDP(s).
CDE Service Level Agreement (SLA)	The agreement entered into by the <i>Employer</i> and <i>Contractor</i> in the form set out at the beginning of the <i>works</i> and that defines the obligations on the <i>Employer</i> for the standards to be applied to the provision, maintenance and availability of the Project Data Environment.
Composite Model	Computer Aided Design (CAD) file(s) displaying one or more Model Files (attached as references), for the purpose of performing coordination activities and / or compiling Document Definitions.
Documentation	Native Files and / or Data Files and / or Document Renditions.
Document Definition	Data file produced, containing a view of the Non-Graphical Data and / or Model File(s) and / or Composite Model(s), to derive meaning for a specific purpose.
Document Rendition	A data file in an immutable format, derived from a Document Definition.
Employer's Information Requirements (EIR)	Sets out the standards to be used and required details relating to the data and information about the <i>Employer's</i> engineered asset's physical and functional characteristics, how these shall be captured, produced, generated, utilised and managed by its suppliers. An EIR template can be found in Appendix 11.1.
Master Information Delivery Plan (MIDP)	A forward looking schedule that defines the maturity of the Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) which are to be produced, maintained and delivered as Production Information and Handover Information. The MIDP can be found in Appendix 11.2. The plan specifies the subject matter of each Model, the person who is to produce and deliver each Model and the Level of Definition for each Model at each Stage and is appended to the BIM Protocol. The BIM Protocol can be found in Appendix 11.3.
Model	A digital representation of part of the physical and / or functional characteristics of the <i>works</i> .
Model File	Computer Aided Design (CAD) file(s) containing shape(s) with

	defined origin, orientation and dimensions, communicating the physical characteristics of the works. A Model File may also include Non-Graphical Data, associated to the CAD file(s) and / or shape(s), identifying the functional characteristics of the works.
Native File	Original graphical data and / or non-graphical data file in its default format, as created in the authoring tool.
Non-Graphical Data	Data file containing alphanumeric characters, communicating the physical and functional characteristics of the works.
Project Information Exchange (Plx) Protocol – IT Assessment form	A mechanism for capturing the <i>Employer's, Contractor's, Subcontractor's</i> and supplier's information exchange capability and IT maturity. The forms are to be used to identify any restrictions or limitations in the production, use and management of the Production Information and Handover Information. The forms also capture the agreed information exchange file formats and versions. The Project Information Exchange (Plx) Protocol – IT Assessment form can be found in Appendix 11.4.
Production Information and Handover Information	The Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) to be produced, updated and maintained in order to Provide the Works and be delivered, during the <i>works</i> , as set out in the MIDP(s) until the defects certificate is issued. Referred to as the Project Information Model (PIM) within PAS1192-2.
Project Data Environment	A system which forms part of the Common Data Environment and is accessible to the <i>Employer, the Contractor, Subcontractors</i> or supplier of the <i>Contractor, the Project Manager, the Supervisor</i> and Others (as applicable). It is used to manage and exchange the master version of all shared Production Information and Handover Information.
Task Team Data Environment	A Common Data Environment (CDE) comprising individual Task Team Work in Progress (WIP) areas.
Mandatory Asset Information Database (MAID)	A database to identify and capture the information to be "handed over" by a project, to safely operate and maintain assets affected by the project. This information includes health and safety file information required for compliance with the Construction (Design and Management) Regulations as well as other information required by Maintenance and Operations to maintain and operate the assets.

11.3 Building Information Modelling Responsibilities

- 11.3.1 The *Contractor* provides a Project Information Manager in accordance with the EIR, for the duration of the *works*.
- 11.3.2 The *Employer* provides, manages and maintains the Project Data Environment of the CDE in accordance with the EIR and the CDE SLA in place for the duration of the *works*. The *Employer* ensures accessibility to the *Contractor*, Subcontractors or suppliers of the *Contractor* and Others (as applicable) as arranged by the *Project Manager*.
- 11.3.3 The *Contractor* shall generate all Production Information and Handover Information within their Task Team Data Environments, configured, managed and maintained in accordance with BS1192:2016-A2 and PAS1192:2 processes. The *Contractor* ensures accessibility for their team, any Subcontractor or suppliers of the *Contractor* until Final Completion. The *Contractor*, Subcontractors or supplier of the *Contractor* shares all agreed Production Information and Handover Information with the *Project Manager* and *Employer* via the Project Data Environment.
- 11.3.4 The *Contractor* is responsible for completing, updating and maintaining the MIDP(s) and BEP, provided by the *Contractor*.
- 11.3.5 The *Contractor* shall produce, update and maintain Production Information and Handover Information in accordance with the accepted MIDP(s) and BEP provided by the *Contractor*.
- 11.3.6 The *Contractor* shall produce, use, update and manage Production Information and Handover Information through the Common Data Environment (CDE).
- 11.3.7 The *Contractor* is responsible for and maintain the integrity and compatibility of the Production Information and Handover Information.
- 11.3.8 The *Contractor* is responsible for the coordination and integration of the works contained within the Model Files and / or included as part of the Non-Graphical Data, across all disciplines, with Others, with existing infrastructure and properties and any adjacent works.
- 11.3.9 The *Contractor* formally submits all Production Information and Handover Information to the *Project Manager* for sharing and acceptance through TfL's designated Project Data Environment of the CDE.
- 11.3.10 The *Contractor* manages production, sharing and handover of Production and Handover Information in accordance with TfL Standard S1760 Standard Method and Procedure (SMP) and Common Data Environment (CDE).

11.4 Building Information Modelling Process

11.4.1 Building Information Modelling Process

- 11.4.1.1 The *Contractor* delivers the *works* in accordance with the EIR.

11.4.2 Master Information Delivery Plan (MIDP)

- 11.4.2.1 The *Contractor* produces, updates and maintains the MIDP in accordance with the EIR (Appendix 11.1).

11.4.3 BIM Execution Plan (BEP)

11.4.3.1 The *Contractor* delivers the *works* in accordance with the *Contractor's* BEP.

11.4.3.2 The *Contractor* produces updates and maintains the BEP in accordance with the terms set out in EIR (Appendix 11.1).

11.4.4 Project Information Exchange (Plx) Protocol IT Assessment Form

11.4.4.1 The *Contractor* shall complete, update and maintain the Plx IT Assessment Form in accordance with the EIR.

11.4.5 Mandatory Asset Information Database (MAID)

11.4.5.1 The *Contractor* shall ensure that the MAID deliverables are produced and filed in accordance with the structure shown in EIR (Appendix 11.1). The *Project Manager* reviews and accepts MAID deliverables prior to the Final Completion.

11.5 Building Information Modelling Coordination Process

11.5.1 The *Contractor* is responsible for (and provide evidence as part of the Production Information and Handover Information and as required by the *Project Manager*, to verify that) the *works* are fully co-ordinated and integrated across all disciplines, with Others with existing infrastructure and properties and any adjacent works.

11.5.2 The *Contractor* demonstrates the effectiveness of any value engineering using the Production Information.

11.6 Building Information Modelling Submission Procedures

11.6.1 The *Contractor* submits to the *Project Manager* for acceptance the Production Information and Handover Information as set out in the accepted MIDP(s) provided by the *Contractor*, in accordance with TfL Standard S1760 Standard Method and Procedure (SMP) and Common Data Environment (CDE), EIR and Accepted Programme.

11.6.2 The *Project Manager* either accepts the submission or notifies the *Contractor* of his reasons for rejection. Reasons for rejection are (but are not limited to):

- Production Information and / or Handover Information are not submitted through the CDE in accordance with the EIR.
- Production Information and / or Handover Information do not comply with TfL Standards.
- Production Information and / or Handover Information are not developed to an appropriate level of maturity such that the acceptance criteria and requisite level of assurance for the *works* can be achieved.

11.6.3 There is no acceptance/rejection in respect of interim submissions; therefore the *Project Manager's* response will be in the form of comments only.

Appendix 11.1 – Employers Information Requirements (EIR)

See document titled: “*Appendix_11.1_-_Employers_Information_Requirements_(EIR).docx*”

Appendix 11.2 – Master Information Delivery Plan (MiDP) Template

See document titled: *“Appendix_11.2_-_Master_Information_Delivery_Plan_(MIDP).xlsx”*

Appendix 11.3 – BIM Protocol

See document titled: "*Appendix_11.3_-_BIM_Protocol.docx*"

Appendix 11.4 – Plx Protocol – IT Assessment Template

See document titled: "*Appenidx_11.4_-_Plx_Protocol_-_IT_Assessent.docx*"

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 19

Health and Safety

Table of Contents

19.1	General Health and Safety Requirements	1
19.2	Glossary	2
19.3	HSE Objectives and Targets for Contractors	3
19.4	Particular Health & Safety Requirements	6
19.5	Occupational Health	7
19.6	The Construction (Design and Management) Regulations 2015	14
19.7	Work Related Road Risk	17
19.8	Procedures	21
19.9	Construction Phase & Environmental Plans Requirements	22
19.10	Police and Traffic Regulations	24
19.11	Documentation Submission and Acceptance	24
19.12	Health and Safety Staffing	24
19.13	Communication	26
Appendix 19.1	F10 Notification	29
Appendix 19.2	Direct Vision Standard (DVS)	30

19.1 General Health and Safety Requirements

19.1.1 Applicable Standards and Performance Monitoring.

- (a) The *Contractor* complies with all of the requirements listed in the Contract QUENSH Conditions menu included in SWI 19, Appendix 19.1.
- (b) The *Contractor* complies with the London Underground Limited (LUL) Health, and Safety Management System ‘Standards’ containing mandatory Category 1 Standards and, if stated, Category 2 and 5 Standards, Guidance Documents and template documentation.
- (c) The *Contractor’s* health and safety performance is monitored by LUL using the LUL Supplier HSE Maturity Assessment as detailed in section 19.3 - HSE Objectives and Targets for Contractors. The default frequency for assessment against the criteria is quarterly, though this may be varied by LUL in light of the level of activity or performance. The *Contractor* participates in the assessment through the provision of information and evidence requested by LUL in respect of the criteria. The results of the assessment will be discussed with the *Contractor* upon completion. If required, the *Contractor* will be asked to prepare an Action Plan in response; progress against which is monitored as part of subsequent assessments. The full assessment criteria will be shared with the *Contractor* after commencement of the Order.

19.1.2 LUL Mandatory Asset Information Deliverables.

The *Contractor* provides the *Project Manager* with all necessary documentation required by the LUL Mandatory Asset Information Deliverables (MAID) for the work they are undertaking. The *works* are not considered Complete unless the *Project Manager* is in possession of all Health and Safety information required to meet the MAID requirements.

19.1.3 Facilities & Services.

- (a) The *Contractor* shall refer to CWI 20 Working with the Employer and Others, for details of facilities to be provided to the *Contractor* for its use, and for those which the *Contractor* is required to provide for Others and or the *Employer’s* use.
- (b) The *Contractor* is responsible for cleaning, inspecting and maintaining all sanitary conveniences and facilities provided in the Working Areas, whether shared or provided for use by the *Contractor* or *Employer*.

19.1.4 HSE Initiatives.

The *Contractor* ensures that his staff participates in the Health and Safety initiatives that the *Employer* uses to review and improve Health and Safety performance collectively with the *Employer’s* supply chain. This includes the requirement to attend routine HSE committee meetings, briefings and forums, and to cascade, communicate and circulate associated bulletins and notices.

19.1.5 Audit Schedule

- (a) The *Contractor* provides a Health and Safety audit schedule in accordance with QUENSH in SWI Appendix 19.1.
- (b) The reports completed after all audits shall be forwarded to the *Project Manager*, for information, within two (2) weeks of the audit being carried out. The report shall include details of any identified issues and any proposed corrective actions. The report shall be reviewed during the periodic progress meetings.
- (c) The *Contractor* ensures that the *Project Manager* is notified a minimum of two (2) weeks in advance of any audits that are to be undertaken, so that the *Project Manager* may attend and witness the audit.
- (d) Where an inspection identifies a non-compliance or issue for improvement, the *Contractor* shall detail the action required, the name of the individual responsible for the action and a reasonable timescale for completing the action. The identified person shall be responsible for closing out the action within the stated timescale.
- (e) The *Contractor's* health and safety audits shall be undertaken by a person qualified by training and experience to undertake such audits. The proposed auditor's competence shall be accepted by the *Project Manager* before such audits take place.

19.2 Glossary

Term	Definition
Action Plan	<i>Contractor</i> improvement proposal(s) that address the issues identified in the LUL HSE assessment.
HSE	Health Safety and Environment
HSE Maturity Assessment	LUL's review of contractors performance against the HSE objectives and targets
MAID	LUL's Mandatory Asset Information Deliverables template that contains all the possible deliverables for projects.
Pre Construction Information	An information pack to provide the Contractor with project specific health, safety and environmental (HSE) information required to identify hazards and risks associated with the work.
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013. These Regulations require employers, the self-employed and those in control of premises to report specified workplace incidents
Safe System of Work (SSoW)	The <i>Contractor</i> assesses all safe systems of work in relation to the risks advised by the <i>Project Manager</i>

19.3 HSE Objectives and Targets for Contractors

- 19.3.1 LUL sets its Contractors a number of HSE objectives which are in line with its major projects directorate HSE strategy and procurement toolkit. Each HSE objective is associated with a number of performance areas and quality criteria', which allow LUL to systematically measure *Contractors'* HSE performance against set objectives.
- 19.3.2 The aim of the assessment is to enable LUL to carry out more meaningful analysis, identify trends and ultimately work better with our supply chain to improve health, safety and environment to achieve the goal of "everyone home safe and healthy every day".
- 19.3.3 LUL HSE Managers carry out supplier assessments using the applicable criteria with a standardised process and toolkit. The default frequency for the assessment of performance against the quality criteria is quarterly, but this may be varied by the LUL HSE managers in light of the level of activity, or the performance achieved. The assessment results show as red/amber/green and are discussed and shared with *Contractors*. It is required that *Contractors* work on improving their HSE performance to such a standard that all HSE objectives show green within twenty six (26) weeks of the Contract Commencement Date.
- 19.3.4 Where objectives score amber or red, *Contractors* are required to put in place an appropriate Action Plan that addresses the issues identified during the assessment and to report progress against this plan back to the *Employer*. The *Employer* requires *Contractors* to improve their performance as follows:
- Green scores = remain green
 - Amber scores = turn green by the following quarter
 - Red scores = turn amber (if not green) by the next quarter and green by the quarter after that
- 19.3.5 The LUL HSE manager will discuss the HSE supplier assessment criteria in detail with the *Contractor* once the contract has been awarded. The objectives and associated performance measures are as follows:

HSE Leadership & Culture:

Objective:

The *Contractor* actively promotes a positive HSE culture and displays excellent HSE leadership.

Target: Green scores for the following:

Engagement & Two-way Communications

Allocation of Responsibilities & Accountabilities for HSE

Leadership & Behaviours on HSE matters

Continuous Improvement

Over & Above: Excellence in HSE Leadership and Behaviours

Communication, Cooperation, Coordination & Information:**Objectives:**

The *Contractor* effectively communicates with all affected parties to ensure that everyone receives the HSE information relevant to them and that all stakeholders are engaged in a timely manner. The supplier cooperates with all affected parties and coordinates works in such a way that ensures the safety of people, infrastructure and environment.

Target: Green scores for the following:

Communication Plans & Information Management

Workforce consultation

Cooperation, Coordination & Joined-Up Working with others

Provision of Mandatory Asset Information Deliverable information

Competence:**Objective:**

The *Contractor* project team and site personnel are fully competent to carry out their work safely and in compliance with legislation.

Target: Green scores for the following:

Managing Competency

HSE Roles and Responsibilities

HSE Risk, Works and Site Management:**Objective for Delivery only, not applicable to Design Contracts:**

HSE risks to all affected parties are adequately identified, assessed and controlled in compliance with applicable legislation and TfL Standards.

Targets: Green scores for the following:

HSE Surveys

Boundaries & Security & Traffic Management

Emergency Planning

Housekeeping, Welfare and Waste Management

HSE Plans, CDM Documentation, Licences & Consents

Inductions & Briefings

Managing Nuisance & Complaints

Risk Assessments & SSoW

Temporary Structures

Managing Ecology and Sustainability

Compliance with Principal Contractors Site Rules, Processes and Instructions

Equipment and Personal Protective Equipment (PPE)

HSE Risk in Design:

Objective for Design only, not applicable to Delivery Contracts:

HSE risks associated with the full lifecycle of the design are adequately identified, assessed and controlled in compliance with applicable legislation and TfL Standards.

Targets: Green scores for the following:

HSE Surveys

HSE Plans, CDM Documentation, Licences & Consents

Identifying & Managing HSE Design Risks

Managing Subcontractors:

Objective:

All of the *Contractors* Subcontractors are competent and their performance is adequately monitored and managed.

Targets: Green scores for the following:

Monitoring HSE performance of Subcontractors

On-Site Supervision of Subcontractors and Coordination of Works

Sharing Information and Communicating with Subcontractors

HSE Competency of Subcontractors

Managing Incidents:

Objective:

All accidents, incidents and near misses are reported, investigated and managed in compliance with TfL Standards and HSE legislation.

Targets: Green scores for the following:

Incident Reporting

Incident Investigation

Managing Actions & Preventing Re-Occurrence of Incidents

Managing the Impact of Incidents on the Operational Railway

HSE Performance Review & Continuous Improvement:

Objectives:

The *Contractor* sets appropriate HSE targets and objectives and reliably monitors their performance against these. Performance data is used by the supplier to inform improvement plans with the aim of continuously improving their HSE performance.

Targets: Green scores for the following:

Continuous Improvement

Inspections & Audits

Performance Data

Managing the LUL Quarterly Performance Review/Assessment

19.4 Particular Health & Safety Requirements

19.4.1 Contractor's Health & Safety Management

The *Contractor* implements and maintains a health and safety management system that, as a minimum, meets the requirements contained in BS OHSAS 18001 Occupational Health and Safety Management, ISO 45001 Occupational Health and Safety and HSG65 Managing for Health and Safety, or similar.

19.4.2 Health & Safety Training

- (a) The *Contractor* shall determine the Health & Safety competency and training requirements for all staff working on the project. The *Contractor* makes full allowance in programming, controlling and executing the works for Health & Safety training requirements.
- (b) In particular, training shall be provided early in the programme to raise awareness of how health, safety, environmental and sustainability initiatives can be incorporated into the design and construction phases to maximise performance in these areas and assist with mitigating any associated impacts.
- (c) Specific training shall also be provided to construction staff to ensure they are aware of the required mitigation measures, detailed in the Construction Phase Plan and the code of construction practices.

19.4.3 Construction Skills Certification Scheme

- (a) The *Contractor* shall ensure that all employees, visitors, subcontractors and suppliers of any tier and other contractors entering the Working Areas are in possession of a valid Construction Skills Certification Scheme (CSCS) card. The *Contractor* shall ensure that the CSCS card held by individuals is appropriate to the specific role on the project.
- (b) An exception to this requirement is granted where the individual holds a valid card from a CSCS affiliated or amalgamated scheme or other accepted scheme which has been assessed as meeting similar standards. Special dispensation may given by the *Project Manager* to allow to *Contractor* to provide access to visitors when on an accompanied site visit.

19.4.4 Site Hazards

- (a) The *Contractor* is to consider the Site hazards identified by the *Employer* in association with the *works* contained in the Pre Construction Information document.
- (b) The *Contractor* is to also consider the Site hazards that are normally associated with working on a LUL Network. These include, but are not limited to:
 - confined spaces;
 - restricted working heights;
 - asbestos containing materials;
 - buried as well as hidden cables;
 - hazardous materials;
 - uneven surfaces;
 - high and low voltage cables and station & communication equipment rooms;
 - moving machinery;
 - moving trains; and
 - working close proximity to track and LUL assets.
- (c) The *Contractor* is to undertake its own 'site hazard survey' prior to starting works on site.

19.5 Occupational Health

19.5.1 General Requirements

- (a) The *Employer* believes that an exemplary standard of occupational health across the Project is essential in delivering the *Employer's* Health, Safety and Environment policy commitments and objectives. This can have a positive effect on the *Contractor's* workforce health where actively managed.

- (b) The *Contractor* shall procure occupational health services and shall submit to the *Project Manager* for acceptance the name of the occupational health services provider from whom the *Contractor* intends to procure occupational health services together with demonstration that the level of service proposed will meet the requirements of this contract.
- (c) The *Contractor's* occupational health services provider shall work with the *Contractor* to achieve the *Employer's* overall objectives for occupational health in the context of the following four elements of activity:
- design of structures/ facilities to be built;
 - procurement of Equipment, Plant and Materials to be used;
 - planning of construction work and determining the method of working through risk assessment; and
 - delivery of the *works* in construction, commissioning and operations.
- (d) Specialist providers shall be available to promote health surveillance, health awareness and general occupational health arrangements.

19.5.2 Occupational Health Services

The following reactive occupational health services are mandatory and shall be provided for each individual engaged by the *Contractor* (including the employees of Site based subcontractors and suppliers of any tier):

- providing first aid and emergency response services to be operated from Site based facilities appropriate to each work location;
- providing a treatment service for those likely to have difficulty accessing medical care locally;
- testing for drugs and alcohol in individuals in accordance with the requirements of QUENSH and the Works Information;
- providing health questionnaire on commencement for all individuals including Site and office based staff;
- providing specific health appraisals for those referred following evaluation of questionnaires;
- providing specific health surveillance for those requiring such surveillance under regulations (defined by risk assessment);
- providing occupational hygiene services to support and assess ill health prevention management;
- providing the opportunity for annual health checks for operatives, including
- general health, personal guidance, health promotion, etc. and to include relevant factors for safety critical workers;
- contributing to the effectiveness of attendance management, rehabilitation and return-to-work programmes and support for ill health incidence investigation where necessary; and

- providing health promotion programmes applicable to construction operatives' workplace and lifestyle

19.5.3 Additional occupational health services to be provided

In addition to the 'reactive' and 'preventative' occupational health services detailed above, the following additional occupational health services are to be provided:

- provision of advice and guidance on occupational health to the *Contractor*;
- contributing to the development and continuous improvement of the occupational health strategy through cooperation with the *Employer*;
- providing advice to the *Contractor's* supply chain to assist in compliance with the *Employer's* occupational health standards;
- ensuring suitable record keeping through a central database; and
- compiling periodic reports detailing activity and achievements.

19.5.4 Impact of Health on Performance

The *Contractor* shall implement suitable and sufficient processes to control the impact of health on performance in the areas of fitness for work and health surveillance as described in section 19.7.6 below

19.5.5 Fitness to Work

Safety Critical and Non-Safety Critical Workers

- (a) The *Contractor* defines a range of activities as safety critical. The *Contractor* provides and maintains a process to ensure sufficient health arrangements including, but not limited to, fitness to work. When assessing activities that are safety critical the *Contractor* shall take due cognisance of statutory regulations that define safety critical works (such as The Railways and Other Guided Transport Systems (Safety) Regulations 2006).
- (b) The *Contractor* shall select safety critical workers based on levels of competences, specific hazards or working conditions, including but not limited to; work at height, electricians. The *Contractor* shall assess all non-safety critical staff by a paper screening process, which shall be reviewed by the *Contractor's* nominated occupational health provider, and follow up consultations arranged where the assessor deems necessary. This assessment should take place prior to allowing an individual to commence work and it should be repeated annually unless alternative timescales are agreed by the *Project Manager*.
- (c) The *Contractor* shall also ensure occupational health assessments are performed for any worker who has been referred by other means (including self-referral).

Periodic Health Assessments

The *Contractor* shall implement a process that identifies those workers who require periodic assessment due to legal or other occupational health defined requirements. The period and nature of the assessment shall be defined by the *Contractor's* approved occupational health provider in response to the nature and risks associated with the work that is being carried out and any circumstances of the individual.

Health Surveillance

The *Contractor* shall, as a minimum, have agreed occupational health protocols for the following surveillance as applicable:

- Hand arm vibration syndrome (HAVS) related health surveillance that is conducted pre-exposure, after twenty-six (26) weeks and annually thereafter;
- Noise health surveillance that is carried out pre-exposure and annually for at least two years. Thereafter the frequency of further occupational health surveillance shall be between one to three years depending on risk assessment based on previous results and task;
- Control of substances hazardous to health (COSHH) surveillance, where a situation has been identified where surveillance is deemed necessary;
- Respiratory health surveillance; and
- Dermatological / skin health surveillance.

Alcohol and Drugs

- (a) The *Contractor* shall enforce a strict alcohol and drugs policy across the Project that shall apply to all persons (including Subcontractors and suppliers of any tier) engaged on the *works*. The policy shall be consistent with the *Employer's* policy and shall apply to all persons whether based within the Working Areas or travelling to and from the *working areas* in connection with the *works*.
- (b) No alcohol or drugs shall be brought into or consumed by any person within the *working areas* and associated welfare facilities or delivering Equipment or Plant and Materials, including but not limited to temporary facilities.
- (c) Any person suspected of being under the influence of alcohol and/or drugs shall be refused entry to the Working Areas or required to leave the Working Areas and subject to testing by the *Contractor's* approved occupational health provider.
- (d) The *Project Manager* shall inform police of any person working on the Project who is found or believed to be supplying illegal drugs. The *Contractor* shall provide all required assistance to the *Project Manager* and the police and shall take appropriate measures to exclude any such persons from the *working areas*.
- (e) The *Contractor* shall advise the *Project Manager* of any personnel who are 'safety critical' and are under any form of prescription medication without delay and comply with any direction given.
- (f) The *Contractor* shall ensure that adequate processes are in place to allow the *Employer* and/or the *Project Manager* to undertake "for cause" drugs and alcohol testing of any manager or operative where it is deemed necessary as part of an investigation.

- (g) The *Contractor* shall implement suitable arrangements to verify compliance with the *Employer's* Alcohol & Drugs policy (provided in CWI 29 Standards and Guidance) including undertaking the necessary alcohol & drug testing and in addition the *Contractor* shall co-operate with the *Employer* who may arrange for the execution of "Random" and/or "For Cause" Alcohol and Drugs test.
- (h) For the purposes of this part of the Works Information;
- "For Cause Test" means – A drugs and alcohol test undertaken to identify whether or not drugs or alcohol affected a persons behaviour resulting in acts or omissions which caused, or could have caused an incident or accident or where there is reasonable ground to suspect that a person is in breach of the drugs and alcohol policy.
 - "Random test" means – A drugs and alcohol test undertaken to determine the effectiveness of the drugs and alcohol policy and to verify compliance at a given date and time. The selection of staff that is required to submit to random testing shall be done in a way that minimises disruption but the *Project Manager* reserves;
 - the right to undertake an appropriate level of testing to verify compliance with the *Contractor's* Policy.
- (i) For the Random Testing programme, the *Contractor* shall perform testing based on the following requirements:
- 10% of non-manual employees annually;
 - 10% of manual employees annually;
 - 10% of lorry drivers; and
 - 10% of Subcontractors and suppliers (of any tier) employees annually.
- (j) A positive result will be recorded when the test identifies the presence of a drug for which there is no legitimate medical need or where the level of alcohol exceeds:
- 29 milligrams of alcohol in 100 millilitres of blood; or
 - 13 micrograms of alcohol in 100 millilitres of breath; or
 - 39 milligrams of alcohol in 100 millilitres of urine.
- (k) Refusal to submit to a drugs & alcohol test or evidence that a test sample has been altered or corrupted shall be regarded as a positive result and will require investigation and action.
- (l) Suitable arrangements shall also be provided by the *Contractor* as part of the overall Occupational Health programme to identify and assist those with a alcohol or drug dependency, allowing for rehabilitation and or disciplinary actions where breach of site rules apply.
- (m) The *Contractor* shall ensure that employees who refuse to consent to alcohol screening or search protocols will be subjected to disciplinary actions.

Clarification of Drugs & Alcohol testing arrangements for the *Employers* staff and non-permanent labour

- (a) The *Employers* staff and non-permanent labour are already subject TfL Standard S1257 Drugs and Work and TfL Standard S1251 Alcohol and Work that form part of their contractual arrangements. These arrangements have been agreed with both the trade unions and regulator and ensure a consistency of application in line with the agreed contractual arrangements; irrespective of their work location.
- (b) The *Contractor's* own drug & alcohol (D&A) testing arrangements, including those which form a part of the site induction process, should therefore not be applied to LUL and TfL employees and non-permanent labour. Instead the following applies:
- If the *Contractor* has reason to believe, that an *Employers* permanent or temporary staff member, is not presenting themselves as fit for duty, and free of drugs and alcohol, he should contact the *Project Manager* immediately – who will then, arrange for the individual to be D&A tested, in accordance with the relevant TfL Standards.

In the event of an incident, where “for cause” testing is required for an *Employers* permanent or temporary staff member, contact should be made with the *Project Manager* immediately – who will arrange for the individual to be tested, in accordance with the relevant TfL Standards.

Employee Wellbeing

The *Contractor* shall ensure processes are in place that addresses employee wellbeing by raising awareness of both work related and lifestyle health issues through campaigns, lifestyle screening and education. The *Employer's* nominated occupational health service provider shall give leadership and co-ordination in this area.

Campaigns and Education

The *Contractor's* occupational health provider shall utilise campaigns and targeted health education to:

- Reduce the risks to workers acquiring occupational disease by providing appropriate information on risks and control measures; and
- Respond to adverse occupational health trends.

Lifestyle screening

The *Contractor's* approved occupational health provider shall make available lifestyle screening to all employees working on the Project to enable early detection and intervention of identified issues. Lifestyle screening is to be made available on an annual basis as a minimum.

First Aid & Medical Arrangements

The *Contractor* shall make suitable and sufficient arrangements for first aid and medical facilities and assess their requirements based on:

- the nature of the work and workplace hazards and risks;
- the size of the organisation;

- the nature of the workforce;
- the organisation's history of accidents;
- the needs of travelling, remote and lone workers;
- work patterns;
- the distribution of the workforce;
- the remoteness of the Site from emergency medical services;
- employees working on shared or multi-occupied sites;
- annual leave and other absences of first-aiders and appointed persons;
- First-aid provision for non-employees;
- arrangements for reporting injuries from first aid to RIDDOR events;
- training of first aiders and medical practitioners; and
- First aid and medical facilities to be provided.

Welfare Arrangements and Hygiene

- (a) The *Contractor* shall provide quality welfare facilities to support the overall occupational health programme. Welfare facilities must be established and in working order before any works on Site commence. All toilet, washing, changing, personal storage and rest areas must be easily accessible and have adequate heating, lighting and ventilation. Facilities may need to be provided at more than one location on a large Site to ensure workers have easy access. The *Contractor* shall provide arrangements to ensure good hygiene standards throughout the welfare and office facilities provided. As a minimum the *Contractor* shall ensure that all of the following are provided before the *works* commence:
- washing facilities (including provision of barrier and after care skin treatments etc.);
 - facilities for storage and drying of work wear;
 - rest facilities;
 - designated smoking areas;
 - drinking water;
 - general maintenance and cleaning; and
 - welfare vehicles / temporary facilities.
- (b) The *Contractor* may use portable toilet/wash facilities on worksite where the duration of works does not exceed one (1) week.

19.6 The Construction (Design and Management) Regulations 2015

- 19.6.1 The *Employer* is the Client for the purposes of the CDM Regulations 2015.
- 19.6.2 The *Contractor* is appointed as Principal Contractor and Principal Designer as required by the CDM Regulations 2015.
- 19.6.3 Appendix 19.1 contains a copy of the *Employer's* F10 Notification informing the Health & Safety Executive Office of the Rail and Road (ORR) of this Project's planned construction works in accordance with CDM Regulations 2015. Upon request by the *Project Manager*, the *Contractor* must display the *Employer's* F10 Notification in its site office in accordance with regulation 6(3)(b) of the CDM Regulations 2015.
- 19.6.4 The *Contractor* acknowledges the *Employer's* statutory duty to provide a safe and efficient public passenger transport service and the *Contractor* is to, at all times during the *works*, have regard to those statutory duties. The *Contractor* does not in Providing the Works in any manner endanger the safety of or interferes with the convenience of the underground network or the public and takes all reasonable steps to minimise any disruption to the same.
- 19.6.5 Personal Protective Equipment (PPE) and clothing.

The *Contractor* assesses and provides the appropriate PPE requirements for use of his personnel and subcontractors as follows:

- (a) The *Contractor* provides PPE free of charge to all personnel, as required and appropriate, for the job task.
- (b) PPE fits the individual and is laundered, maintained and/or replaced to ensure that it remains effective at all time.
- (c) The minimum equipment to be provided is:
 - Hard hat with company branding;
 - Eye protection (safety glasses);
 - Hand protection (gloves);
 - Safety footwear;
 - High visibility jacket and/or vest with company branding; and
 - High visibility trousers.
- (d) Dependant on the job task function and Site conditions, personnel are also provided as a minimum with:
 - Respiratory protection equipment (which can be properly fitted for all users);
 - Hearing protection;
 - Hot, wet or inclement weather protection.
- (e) The *Contractor* ensures that all PPE is suited to the task on the basis of health risk assessment. Details of the PPE to be used should be included in the Construction Phase Plan and the respective Safe System of Work.

- (f) The *Contractor* ensures that all personnel wear PPE appropriate to the health risks of each task and demonstrate that health risk control systems are in place.
- (g) High visibility clothing shall be flame retardant.

19.6.6 *Employer's PPE and clothing requirements.*

- (a) The *Contractor* provides PPE and clothing requirements to be provided for use on site by the *Project Manager*, his staff and other agents involved in the contract.
- (b) The PPE to be provided by the Contractor for visitors to the site is in accordance with section 19.6.5.

19.6.7 Use of equipment, materials or substances hazardous to health.

- (a) The *Contractor* gives the *Project Manager* such written notice as the *Project Manager* requires prior to the use under the contract of any equipment, materials or substances that may be hazardous and a risk to the safety, health or welfare of persons or property. The *Contractor* identifies the hazards and provides full details of any precautions to be taken on the use of such equipment or materials.
- (b) The *Contractor* only specifies substances and materials for incorporation in the works;
 - which are in accordance with the relevant TfL Standards and general good building and engineering practice; and
 - which are in accordance with the guidelines contained in any publication of the Building Council of Offices' "Good Practice in the selection of Construction Materials" current at the time of incorporation of such substances or materials into the works.
- (c) The *Contractor* informs the *Project Manager* if he considers that any material or substance which he is required by drawings or specification to incorporate into the works does not comply with the above.

19.6.8 Fire.

- (a) The *Contractor* ensures that all works are compliant with the relevant legislation, TfL Standards and LUL guidance on fire safety.
- (b) The *Contractor* ensures that regular site inspections include those of the *Contractor's* fire safety arrangements, are recorded and the completed forms are maintained on site in the appropriate site files.
- (c) The Site Person in Charge (SPC) is the primary point of contact for all issues relating to fire safety on the work site. The SPC ensures that all personnel on Site receive a site briefing prior to work commencing and comply with the contents of specific conditions relative to fire safety on the Site. The SPC coordinates all activities relative to fire related emergency procedures in accordance with the station emergency plan(s) (Refer to SWI 19 Health and Safety).
- (d) In the event of a fire emergency the *Contractor* complies with the requirements of the station emergency plan (Refer to SWI 19 Health and Safety) in order to ensure a speedy evacuation of the Site and to account for all personnel.

- (e) The *Contractor's* Emergency Plan includes emergency pollution control measures compliant with Environment Agency (EA) guidelines including emergency phone numbers and the method of notifying local authorities and statutory authorities.
- (f) The *Contractor* complies with the requirements of the London Fire and Emergency Planning Authority (LFEPA) or other relevant fire authority for the provision of Site access points. Where appropriate, the accesses are designed to the requirements of LFEPA Publication: Fire Safety Guidance Note Number 29 "Access for Fire Appliances". The access points must also be suitable for access for ambulances.

19.6.9 Isolation of fire protection and detection systems.

- (a) Isolation of automatic fire prevention and detection equipment is controlled in accordance with TfL Standard S1088 and TfL Procedure Document PRO630 Fire Detection Isolations, Smoke to Heat Detector Substitutions.
- (b) The *Contractor* agrees the proposed isolation plan to suit his method of working with the *Project Manager*, and requests the isolation from the Fault Report Centre (FRC).
- (c) As well as requesting isolation from the FRC, the *Contractor* requests exemption from the fire asset engineer, where applicable, no later than two weeks before work is planned to take place and confirms that:
 - the fire asset engineer passes the request to the LFEPA;
 - the fire asset engineer confirms that isolation requests have been approved and where necessary, that exemptions are in place before a hot work permit is issued;
 - the *Contractor* maintains a presence on Site and undertakes an hourly fire inspection of the isolated area until the fire protection or detection system is reinstated.
- (d) The *Contractor* is particularly aware of the procedures for raising the alarm, in the event of outbreak of fire at a location where work activity is taking place.
- (e) The *Contractor* provides dedicated fire points when and where hot works are carried out.

19.7 Work Related Road Risk

19.7.1 Index.

Term	Definition
Approved Progressive Training	An ongoing programme of personal development that uses a combination of theoretical, e-learning, practical and on the job training to ensure Drivers have the knowledge, skills and attitude to operate safely on urban roads and includes: <ol style="list-style-type: none"> i) Safe Urban Driving (SUD) training to be undertaken every five years; or ii) A training course, which in the reasonable opinion of the Employer is an acceptable substitute to SUD; and iii) One safety related FORS e-learning module to be undertaken every twelve (12) months
Bronze Accreditation	The minimum level of accreditation within the FORS Standard, the requirements of which are more particularly described at: www.fors-online.org.uk
Category N2 Lorry	A vehicle designed and constructed for the carriage of goods having a MAM exceeding 3,500 kilograms but not exceeding 12,000 kilograms
Category N3 Lorry	A vehicle designed and constructed for the carriage of goods and having a MAM exceeding 12,000 kilograms
Car-derived Van	A vehicle based on a car, but with an interior that has been altered for the purpose of carrying larger amounts of goods and/or equipment
Collision Report	A report detailing all collisions during the previous twelve (12) months involving injuries to persons or fatalities
Delivery and Servicing Vehicle	A Lorry, a Van or a Car-derived Van
Driver	any employee of the Contractor (including an agency driver), who operates Delivery and Servicing Vehicles on behalf of the Contractor to Provide the Works
DVLA	Driver and Vehicle Licensing Agency
Direct Vision Standard or DVS	A performance based assessment and rating tool, as updated from time to time that measures how much direct vision a Driver has from a Category N3 Lorry cab in relation to other road users. Further information can be found at: www.tfl.gov.uk
FORS	The Fleet Operator Recognition Scheme, which is an accreditation scheme for businesses operating van and lorry fleets. It offers impartial, independent advice and guidance to motivate companies to improve their compliance with relevant laws and their environmental, social and economic performance
FORS Standard	The standard setting out the accreditation requirements for the Fleet Operator Recognition Scheme, a copy of which can be found at: www.fors-online.org.uk
Front Underrun Protection	Devices that are fitted at the front of Lorries and which comply with EC Directive 2000/40/EEC and the Road Vehicles (Construction and Use) Regulations 1986
Gold Accreditation	The highest level of accreditation within the FORS Standard, the requirements of which are more particularly described at: www.fors-online.org.uk

Term	Definition
Lorry	A vehicle with an MAM exceeding 3,500 kilograms
MAM	The maximum authorised mass of a vehicle or trailer including the maximum load that can be carried safely while used on the road
Side Underrun Protection	Devices that are fitted between the front and rear axles of Lorries and which comply with EC Directive 89/297/EEC and the Road Vehicles (Construction and Use) Regulations 1986
Silver Accreditation	The intermediate level of accreditation within the FORS Standard, the requirements of which are more particularly described at: www.fors-online.org.uk
Van	A vehicle with a MAM not exceeding 3,500 kilograms

19.7.2 Fleet Operator Recognition Scheme Membership

Where the *Contractor* operates Delivery and Servicing Vehicles to Provide the Works, within ninety (90) days of the Contract Commencement Date:

- (a) (unless already registered) he registers for FORS or a scheme, which in the reasonable opinion of the *Employer*, is an acceptable substitute to FORS (the “**Alternative Scheme**”); and
- (b) (unless already accredited) he attains the standard of Bronze Accreditation (or higher) or the equivalent within the Alternative Scheme and maintains the standard of Bronze Accreditation (or equivalent standard within the Alternative Scheme) by way of an annual independent assessment in accordance with the FORS Standard or takes such steps as may be required to maintain the equivalent standard within the Alternative Scheme. Alternatively, where the *Contractor* has attained Silver or Gold Accreditation, the maintenance requirements are undertaken in accordance with the periods set out in the FORS Standard.

19.7.3 Safety Features on Lorries

The *Contractor* ensures that every Lorry, which he uses to Provide the Works, has:

- (a) Side Underrun Protection fitted at a height not exceeding 550mm from the ground, unless the *Contractor* can demonstrate to the reasonable satisfaction of the *Employer* that the Lorry will not perform the function for which it was built if the Side Underrun Protection is fitted;
- (b) Front Underrun Protection fitted at a height not exceeding 400mm from the ground, unless the *Contractor* can demonstrate to the reasonable satisfaction of the *Employer* that the Lorry will not perform the function for which it was built if the Front Underrun Protection is fitted;
- (c) equipment fitted with an audible means of warning other road users of the Lorry’s left manoeuvre;
- (d) prominent signage on the Lorry to warn cyclists and other road users of the dangers of the Lorry’s near side blind spot and of getting too close to the Lorry; and
- (e) front, side and rear blind spots completely eliminated or minimised as far as practical and possible, through the use of direct vision, fully operational indirect vision aids and driver audible alerts.

19.7.4 Direct Vision Standard (DVS)

- (a) Where applicable the Contractor complies with the Heavy Goods Vehicle Direct Vision Standard in Appendix 19.2
- (b) The *Contractor* ensures that:
 - from and including 1 October 2018, all Category N3 Lorries used to Provide the Works achieve a minimum of a one (1) star Direct Vision Standard rating;

- from and including 1 April 2020 all Category N3 Lorries used to Provide the Works achieve a minimum of three (3) star Direct Vision Standard rating; and
- so far as reasonably practicable, the conditions at:
 - i) any part of the Site which is within the control of the *Contractor*, or
 - ii) any other site or location which is within the control of the *Contractor* and at which, in order to Provide the Works, waste is being disposed of or supplies are being delivered to or from

are appropriate for each Category N2 Lorry and Category N3 Lorry used to Provide the Works. The *Contractor* does not incur any costs or make any changes to either (i) the Site or (ii) other sites or locations for the purposes of this Section 19.7.4 (b) and (iii) without the prior written consent of the *Employer*

19.7.5 Driver Licence Checks

(a) Where the *Contractor* operates Delivery and Servicing Vehicles to Provide the Works the *Contractor* ensures that:

- he has a system in place to ensure all his Drivers hold a valid driving licence for the category of vehicle that they are tasked to drive, along with recording any endorsements, or restrictions on the Drivers' licences; and
- each of his Drivers engaged to Provide the Works has a driving licence check with the DVLA or such equivalent before that Driver commences work and that the driving licence check with the DVLA or equivalent authority is repeated in accordance with either the following risk scale (in the case of the DVLA issued licences only), or the *Contractor's* risk scale, provided that the *Contractor's* risk scale has been approved in writing by the *Employer* within the last twelve (12) months:
 - i) 0 – 5 points on the driving licence – six monthly checks;
 - ii) 6 – 8 points on the driving licence – quarterly checks; or
 - iii) 9 or more points on the driving licence – monthly checks.

19.7.6 Driver Training

(a) Where the *Contractor* operates Delivery and Servicing Vehicles to Provide the Works the *Contractor* ensures that each of his Drivers attends Approved Progressive Training throughout the duration of the contract.

19.7.7 Collision Reporting

(a) Where the *Contractor* operates Delivery and Servicing Vehicles to Provide the Works, the *Contractor*:

- ensures that he has a system in place to capture, investigate and analyse road traffic collisions that results in fatalities, injury or damage to vehicles, persons or property and for generating Collision Reports; and

- within fifteen (15) days of the Contract Commencement Date, provides to the *Employer* a Collision Report. The *Contractor* provides to the *Employer* an updated Collision Report within five (5) working days of a written request from the *Employer*.

19.7.8 Self-Certification of Compliance

- (a) Where the *Contractor* operates Delivery and Servicing Vehicles to Provide the Works, within ninety (90) days of the Contract Commencement Date, the *Contractor* makes a written report to the *Employer* detailing his compliance with the “WRRR Self-certification Report”. The *Contractor* provides updates of the WRRR Self-certification Report to the *Employer* on each three (3) month anniversary of his submission of the initial WRRR Self-certification Report.

19.7.9 Obligations of the *Contractor* Regarding Subcontractors

- (a) The *Contractor* ensures that those of his Subcontractors who operate Category N2 Lorries, Category N3 Lorries, Vans and/or Car-derived Vans to Provide the Works:
- comply with Section 19.7.2;
 - for Category N2 Lorries, comply with Sections 19.7.3, 19.7.5, 19.7.6, 19.7.7 and 19.7.8
 - for Category N3 Lorries, comply with Sections 19.7.3, 19.7.4, 19.7.5, 19.7.6, 19.7.7 and 19.7.8 and, where applicable, the appropriate provisions of the Heavy Goods Vehicle Direct Vision Standard; and
 - for Vans and Car-derived Vans, comply with Sections 19.7.6, 19.7.7 and 19.7.8.

19.7.10 Failure to Comply with Work Related Road Risk Requirements

- (a) Without limiting the effect of any other clause of this contract relating to termination, if the *Contractor* fails to comply with Sections 19.7.2, 19.7.3, 19.7.4 (where applicable), 19.7.5, 19.7.6, 19.7.7 and 19.7.8:
- the *Contractor* commits a material breach of this contract; and
 - the *Employer* and/or any member of the TfL Group may refuse the *Contractor*, his employees, agents and Delivery and Servicing Vehicles entry onto any property that is owned, occupied or managed by the *Employer* and/or any member of the TfL Group for any purpose (including but not limited to deliveries).

19.8 Procedures

19.8.1 Emergency Plan Procedures

- (a) The emergency plan procedures manual is submitted to the *Project Manager* for acceptance prior to commencement of work on Site.
- (b) The *Contractor* carries out training for key emergency management personnel as required for the effective implementation of the procedures. The emergency arrangements for the works can be included in the Construction Phase Plan if preferred by the *Contractor*.

- (c) The *Contractor* arranges at least one simulated emergency exercise in each twelve (12) week period following commencement of work on Site.
- (d) Immediately following an emergency, or following a simulated emergency exercise, the *Contractor* reviews the actions taken, against the requirements set out in the emergency plan procedures manual, and shall issue revisions to the emergency plan procedures manual when appropriate. The *Contractor* reviews in full the emergency plan procedures at maximum of twenty-six (26) weekly intervals. Any revisions in the emergency plan procedures manual are submitted to the *Project Manager* for acceptance.

19.8.2 Incident Reporting

- (a) The *Contractor* shall, at the earliest opportunity, after the situation has been made safe report the following:
 - Incidents (events that resulted in harm);
 - Near misses/near hits (events that could have resulted in harm);
 - Sub-standard conditions (hazards that have the potential to cause harm); and
 - Sub-standard acts (behaviours or work methods that have the potential to cause incident).
- (b) These are to be reported through the *Employer's* 24 hour, 7 days a week incident line telephone number 02920 266780 or Auto Phone 1558.

19.8.3 Hours Worked Reporting

- (a) To support the analysis of health and safety performance, the *Contractor* provides the *Project Manager* with the details of the number of hours worked (including for the avoidance of doubt, by Subcontractors and other suppliers) for the work carried out, and the number of personnel involved, in each four week period to be stipulated by the *Project Manager*. This data is to be submitted by Tuesday of Week 1 of the following period (based on the LUL Accounting Periods), and includes for all the *Contractor's* staff and personnel expended on the works used in the working areas since last report. The cumulative report is broken down by management, site level supervision and operatives.

19.9 Construction Phase & Environmental Plans Requirements.

19.9.1 General

- (a) The *Contractor* ensures that the Health, Safety and Environment Pre-Construction Information (PCI) pack provided by the *Employer* is considered and addressed in the Construction Phase Plan (CPP) and/or the Environmental Management Plan (EMP). The EMP may be included in the CPP or may be a separate document.
- (b) The construction phase must not start before a suitable CPP and EMP are in place and accepted by the *Project Manager*.

19.9.2 Construction Phase Plan

- (a) The *Contractor* prepares the Construction Phase Plan (CPP) as required by the CDM Regulations 2015 before commencing any construction activities forming part of the *works*. Further to the *Project Manager's* acceptance of the initial CPP, subsequent updates are submitted to the *Project Manager* for review and comment. The *Contractor* responds accordingly to comments raised by the *Project Manager*.

19.9.3 Detailed Safe Systems of Work

- (a) The *Contractor* is responsible for producing all Safe Systems of Work.
- (b) The *Contractor* submits an initial schedule of proposed Safe Systems of Work for use throughout the contract to the *Project Manager* for acceptance at contract start date and provides subsequent updates as the contract develops and as instructed by the *Project Manager*.
- (c) The *Contractor* assesses all Safe Systems of Work in relation to the risks advised by the *Project Manager*. Should the *Contractor* assess that the safe system of work has an effect upon one of these risks, the *Contractor* submits the safe system of work to the *Project Manager* for acceptance prior to the commencement of the element of the *works*. The *Contractor* allows sufficient time for the review and acceptance by the *Project Manager* of the safe system of work. This time shall be a minimum of eight (8) Working Days (minor works) and twenty-two (22) Working Days (complex works). The risks the *Contractor* shall assess to in relation to this clause are:
 - Risk to an exclusion zone defined in a Standard;
 - Risk to TfL operations, operational assets, or safety systems;
 - Risk to an existing TfL asset or and asset already made available under the contract;
 - Risk to the public;
 - Risk to Employers staff; and
 - Risk to third parties
- (d) The *Project Manager* may identify Safe Systems of Work on the *Contractor's* schedule that are required to be reviewed and approved by the *Project Manager* in addition to those identified in section 19.9.3 (c). The *Contractor* provides these Safe Systems of Work to the *Project Manager* for review when requested.
- (e) If the *Project Manager* has commented on a proposed safe system of work that requires a response and/or corrective action, the *Contractor* must respond accordingly allowing sufficient time to obtain the *Project Manager's* acceptance prior to commencing the element of the *works*.
- (f) No element of the *works* commences without a safe system of work being produced and approved by the *Contractor* and provided to the *Project Manager* for information. Where one of the risks identified in section 19.9.3 (c) applies, or where section 19.9.3 (d) applies, no element of the *works* commences without a safe system of work being approved by the *Project Manager*.

- (g) All Safe Systems of Work and supporting documentation, including any relevant approvals from Others, represent and detail the *Contractor's* planned works and addresses construction sequences, co-ordination with third parties and the relevant control and mitigation measures for identified risks.
- (h) With each safe system of work the *Contractor* produces a risk assessment that demonstrates how potential risks resulting from the works have been mitigated to ALARP status.

19.10 Police and Traffic Regulations

19.10.1 Traffic requirements

- (a) The *Contractor* ensures that all lorry drivers are fully advised of the approved routes (and any relevant restrictions) prior to attending Site. The *Contractor* takes a proactive approach to ensuring that drivers adhere to the agreed routes at all times during the execution of the *works*.

19.1.2 Police requirements

- (a) The *Contractor* shall contact the local police to establish their requirements relating to security, emergency arrangements etc. The *Contractor* should provide the Police with contact names and numbers that enable contact with a responsible person at any time.
- (b) Relevant issues should be incorporated into the Construction Phase Plan and Emergency Plan Procedures.

19.11 Documentation Submission and Acceptance

- (a) There are a number of requirements for the *Contractor* to submit documentation to the *Project Manager* (e.g. Plans and Reports). All such documentation shall be submitted for the *Project Manager's* acceptance.
- (b) If the *Project Manager's* acceptance is not provided, the *Contractor* shall revise and resubmit the documentation to the *Project Manager* until such time as acceptance is granted. After which, the *Contractor* shall comply with the accepted documentation.

19.12 Health and Safety Staffing

19.12.1 Staffing Levels and Competencies

- (a) The *Contractor* shall employ a sufficient number of competent and appropriately qualified and experienced health and safety professionals to ensure the full implementation of all the health and safety requirements.
- (b) The *Contractor* shall obtain the *Project Manager's* written consent before the proposed personnel take up health and safety related positions, and prior to implementing any changes to the personnel undertaking these roles.

19.12.2 Health and Safety Manager

- (a) As a minimum, the *Contractor* shall appoint a Health and Safety Manager.
- (b) Unless otherwise agreed with the *Project Manager*, the Health and Safety Manager shall be employed full-time for the duration of the works and shall be the lead point of contact on such matters.
- (c) Any reduction in the Health and Safety Manager's employment on the contract (e.g. as the contract nears completion), shall only be permitted with the written agreement of the *Project Manager*.
- (d) As a minimum, the Health and Safety Manager shall have the following competencies, experience and qualifications:
 - Appropriate senior level experience of managing Health and Safety issues during construction – ideally including experience of significant rail / road projects;
 - Experience of managing Health and Safety teams;
 - A good knowledge and practical experience of developing, implementing and improving Health and Safety management systems compliant BS OHSAS 18001 Occupational Health and Safety Management, ISO 45001 Occupational Health and Safety and HSG65 Managing for Health and Safety or similar
 - A good knowledge and practical experience of legal and policy requirements related to Health and Safety disciplines;
 - Good knowledge and practical experience of using Health and Safety systems to drive high levels of Health and Safety performance and achieve targeted awards;
 - Experience of liaison with stakeholders and competent authorities not limited to Health and Safety Executive, The Office of Rail and Roads, local authorities and residents;
 - Experience of obtaining and complying with environmental consents;
 - Preferably a full member, but otherwise an associate member, of the Institute of Occupational Health and Safety (IOSH) (or equivalent recognised competent body); and
- (e) The Health and Safety Manager shall be available to attend periodic environment meetings with the *Project Manager*, or their nominated representative, to review key environmental issues and progress.

19.12.3 Other Health and Safety Specialists

- (a) As necessary, based on the scope and the level of Health and Safety risk associated with the works, the *Contractor* shall engage a suitable number of Health and Safety specialists to ensure the full implementation of the Health and Safety requirements. All such specialists shall have suitable qualifications and experience.

19.13 Communication

19.13.1 Advanced Notifications

- (a) The *Contractor* shall take a proactive approach to notifying neighbours, including residents, businesses and relevant stakeholders such as hospitals, GP surgeries, churches and schools, in advance of the commencement of any construction or maintenance works that will affect them in any way, including vegetation removal works, noise and vibration impacts, impacts from staff noise, access and welfare or staff parking and travel.
- (b) The *Contractor* shall submit draft notification letters proposed to nearby properties of construction works to the *Employer's* local communities and partnerships representatives (LocalCommunitiesandPartnerships@tfl.gov.uk) for approval no fewer than fifteen (15) Working Days prior to the works commencing, together with a suggested distribution area for the letter drop.
- (c) Notification letters shall include details of the:
 - location of works;
 - reason for the works;
 - information about potential impacts: noise and vibration, parking, staff access and welfare locations;
 - duration of the works;
 - working hours; and
 - The *Employer's* customer services details.
- (d) In ascertaining the distribution area for the letter drop, the *Contractor* shall carefully consider potential impacts of works, including such aspects as noise and vibration, areas affected by staff parking, access or welfare requirements, delivery and loading of equipment
- (e) Letters shall be produced on the *Employer's* letterhead. A template will be supplied by the *Employer* in the first instance a notification letter is required.
- (f) Once the details of the notification letters have been accepted by the *Employer's* Local Communities and Partnership representative, they shall be distributed to all properties potentially affected by the works a minimum of ten (10) Working Days before works commence. The *Contractor* shall undertake the distribution directly.
- (g) A briefing note about work activities that could potentially affect the community shall be provided by the *Contractor* to the *Employer's* Local Communities and Partnerships team in advance of the commencement of the works. This briefing note will be used to brief customer services and other key stakeholders to address any complaints or enquiries. The briefing note shall contain a copy of the notification letter, the agreed distribution area of the letter, a location map of the works, best practicable means used to mitigate potential adverse impacts, an indication of whether a section 61 is required/expected to be agreed by the local

authority (where relevant); and the name and contact details (for internal use only) of the *Contractor's* representative who can provide further information if required according to the complaints handling process.

- (h) Once distribution is complete, the *Contractor* shall provide the *Employer's* Local Communities and Partnerships team with a distribution report which will include details of all properties that had a letter delivered to it.

19.13.2 Complaints Handling

- (a) The *Contractor* shall develop a complaints handling process agreed with the *Project Manager*. As a minimum, the complaints handling process shall include the following:
- inclusion of the *Employer's* customer services details on all public facing communication;
 - information on how complaints and enquiries will be responded to when passed on by the *Employer's* customer services;
 - details of the emergency response system that will be employed for dealing with emergency issues – such as suspected breaches of Section 61 consent conditions, health and safety contraventions including out of hours contacts within the project; and
 - reporting all complaints/enquiries and their responses within twenty-four (24) hours of receipt to the *Employer's* customer services and the Local Communities and Partnerships Team.
- (b) Whilst Providing the Works, the *Contractor* shall be responsible for dealing with Local Authority work-related issues directly, including health and safety concerns. The *Contractor* must notify the *Employer's* Representative and Local Communities and Partnership Representative of any health and safety concerns within twenty-four (24) hours of receiving them. After Completion, any Local Authority queries or issues shall be dealt with by the *Employer's* Local Communities and Partnerships team.

19.13.3 Internal Communication

- (a) The *Contractor* shall take a pro-active approach to informing their team about health and safety issues so that there is a high level of awareness and the opportunities to implement good practice are maximised. As a minimum the *Contractor* shall:
- Nominate a person responsible for promoting internal health and safety communication;
 - Include health and safety issues in the site induction;
 - Brief staff (including subcontractors) about the key health and safety risks and the controls detailed within the CPP;
 - Display health and safety information (including the *Employer's* HSE policy) on noticeboards; and

- Include and review health and safety matters as an item on the progress review meetings.

Appendix 19.1 – F10 Notification

To be provided prior to Contract Award.

Appendix 19.2 - Direct Vision Standard (DVS)

1.0 Introduction

In this Appendix, the following terms have the following meanings:

“**Agreed HGV DVS Plan**” the Initial HGV DVS Plan as updated and approved in accordance with the terms of this Appendix

“**Initial HGV DVS Plan**” the initial plan set out at Annex 1 which sets out and proposes how the Contractor ensures that:

- a) from and including 1 October 2018, all Category N3 Lorries used to Provide the Works achieve a minimum of a one (1) star Direct Vision Standard rating;
- b) from and including 1 April 2020 all Category N3 Lorries used to Provide the Works achieve a minimum of three (3) star Direct Vision Standard rating; and
- c) so far as reasonably practicable, the conditions at:
 - (i) any part of the Site which is within the control of the Contractor, or
 - (ii) any other site or location which is within the control of the Contractor and at which, in order to Provide the Works, any waste is being disposed of or supplies are being delivered to or from,

are appropriate for each Category N2 Lorry and Category N3 Lorry being used to Provide the Works. The Contractor does not incur any costs or make any changes to either (i) the Site or (ii) the other sites or locations for the purposes of Section 19.6.4 (iii) without the prior written consent of the Employer.

2.0 HGV DVS Plan

2.1 The *Contractor* complies with the Initial HGV DVS Plan from the Contract Commencement Date. Within the period of reply the *Employer* either:

- confirms that the Initial HGV DVS Plan is approved, in which case such plan becomes the Agreed HGV DVS Plan; or
- provides the *Contractor* with any comments on and/or amendments to the Initial HGV DVS Plan.

2.2 Within thirty (30) days of receipt of any comments and/or amendments from the *Project Manager*, the *Contractor*:

- develops the Initial HGV DVS Plan to reflect such comments and/or amendments; and
- submits an updated Initial HGV DVS plan to the *Project Manager* for approval.

2.3 Within fifteen (15) days of receipt of the updated Initial HGV DVS Plan, the *Project Manager* confirms that either the updated Initial HGV DVS Plan:

- is approved, in which case it becomes the Agreed HGV DVS Plan; or

- is not approved and provides further comments and/or amendments to the *Contractor* and the *Contractor* revises and resubmits the updated Initial HGV DVS Plan for approval accordingly.

The process set out above is repeated until the updated Initial HGV DVS Plan is approved by the *Project Manager*.

Where the *Project Manager*, acting reasonably, has not approved the updated Initial HGV DVS Plan, the *Contractor* may refer that decision to the *Employer*.

Without limiting any other provision of this contract, the *Contractor*, at no additional cost to the *Employer*, and as part of Providing the Works:

- implements, observes and complies with the Agreed HGV DVS Plan; and
- reviews and amends the Agreed HGV DVS Plan (as necessary) on each twelve (12) month anniversary of the Contract Commencement Date or earlier if requested by the *Project Manager*, to reflect:
 - (i) any changes to the nature of the works
 - (ii) any comments and/or amendments made or proposed by the *Project Manager*.

3.0 HGV DVS Co-ordinator

3.1 The *Contractor* nominates one of his employees with the necessary experience, competency and authority to:

- be responsible for implementation and compliance with the Agreed HGV DVS Plan; and
- act as the *Contractor's* authorised representative on all matters concerning the Agreed HGV DVS Plan (“HGV DVS Co-ordinator”)

3.2 The *Contractor* submits the HGV DVS Co-ordinator’s details to the *Project Manager* and the *Employer*.

4.0 Self Certification and Reporting

On each twelve (12) month anniversary of the Contract Commencement Date, the *Contractor* submits a report to the *Project Manager* which sets out the progress in respect of implementation of the Agreed HGV DVS Plan and confirms (with supporting evidence) that the *Contractor* has complied with the Agreed HGV DVS Plan.

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 20

Working with the Employer and Others

Table of Contents

20.1	General	1
20.2	Glossary	1
20.3	Enabling Works Contractors	1
20.4	Utilities	1
20.5	English Heritage	2
20.6	Rolling Stock Manufacturer's Test Track - Wegberg-Wildenrath, Germany	2
Appendix 20.1 – Not Used		4

20.1 General

20.1.1 This section further defines the *Employer's* specific requirements with regards to working with the *Employer* and Others in the delivery of the *works*.

20.2 Glossary

20.2.1 The following terms are applicable to this CWI 20:

Term	Definition
CER	Communications Equipment Room at stations

20.3 Enabling Works Contractors

20.3.1 The *Employer* has engaged enabling works contractors to ensure the space allocations (Refer to SWI 02 Constraints on the method, order and timing of the *works*) for the OPO equipment in the existing station Communications Equipment Room(s) (CER) are available in advance of the *Contractor's* installation works.

20.3.2 The *Contractor* shall identify in its programme access dates and dates for commencing OPO equipment installation works in CER's. The *Contractor* shall provide the *Project Manager* (upon request) with all information necessary to enable the *Employer* to coordinate these activities.

20.4 Utilities

20.4.1 Known utilities are listed in the relevant Specific Site Information; this information however should not be considered exhaustive.

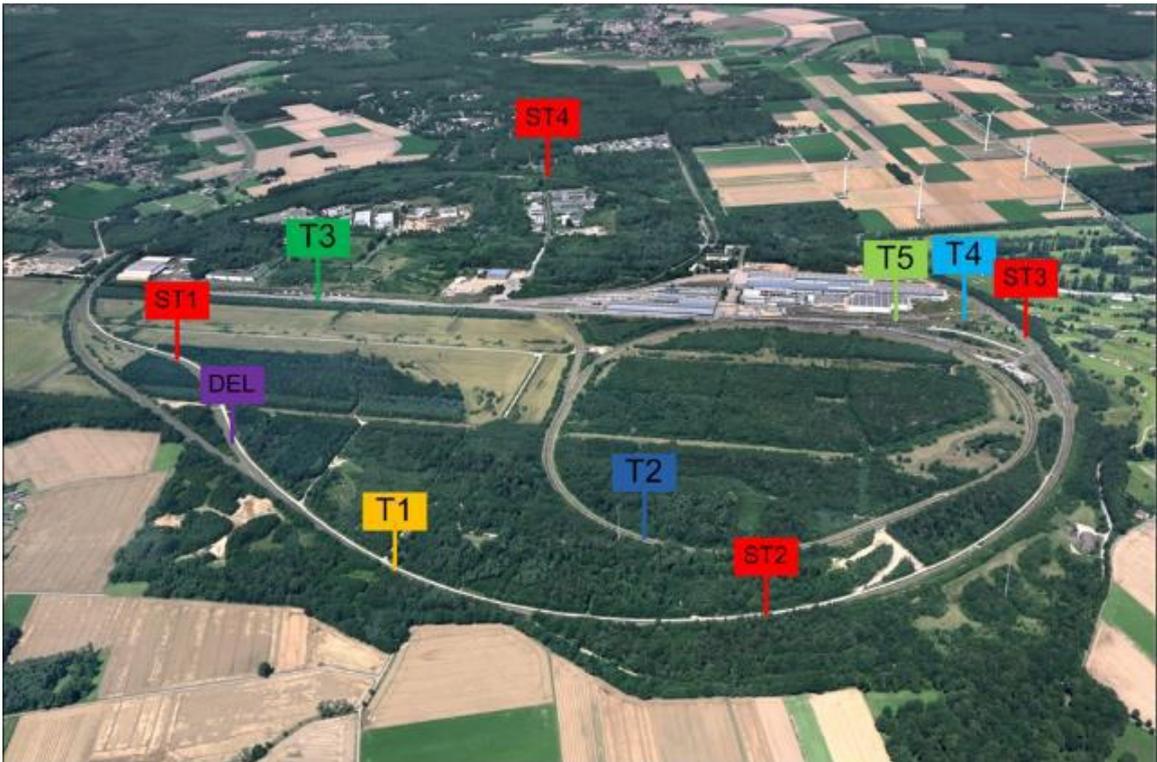
20.4.2 The *Contractor* should design the *works* to avoid disturbing any existing utilities wherever possible.

20.4.3 The *Contractor* as part of the design phase shall carry out all necessary surveys and engage with all utility providers to identify and verify that the *works* will not adversely impact any existing utilities on the LUL Network.

20.5 English Heritage

- 20.5.1 The *Contractor* shall support the *Project Manager* and the *Employer* with all heritage related matters, obtaining consents and participate in meeting with other key stakeholders.
- 20.5.2 Details of known heritage information are contained in SWI 01 Description of the *works*.

20.6 Rolling Stock Manufacturer's Test Track - Wegberg-Wildenrath, Germany



ST1 - proposed temporary platform location

- 20.6.1 A temporary wooden station platform will be constructed by Others at the rolling stock manufacturers test track in Wegberg-Wildenrath, Germany. The *Contractor* shall install, test, commission and make operational the proposed OPO CCTV System on the platform mock-up ready for testing with the Passenger Train.
- 20.6.2 The *Contractor* shall provide all attendance and technical support to facilitate the testing of the OPO CCTV System with the Passenger Train.
- 20.6.3 The *Contractor* in consultation with the *Project Manager* and the test track owner shall provide their own temporary site accommodation, welfare facilities, storage, power, water, lighting, laydown area, etc. at the rolling stock manufacturers test track. The *Contractor* shall remove these temporary facilities and return the area to its original state once the testing of the OPO CCTV system at the test track is complete.
- 20.6.4 All *Contractor* personnel who will be working at the rolling stock manufacturers test track are required to undertake a two (2) part, one (1) day safety induction. The induction is mandatory and a prerequisite to performing any activities at the test track.

- 20.6.5 The *Contractor*, its Subcontractors and suppliers shall comply with any specific health, safety, environmental, security, access and logistic / vehicle movement requirements of the test track.
- 20.6.6 Any passenger international flights associated with activities at the rolling stock manufacturers test track in Wegberg-Wildenrath, Germany, shall be on the basis of least cost economy unless prior agreed by the *Project Manager*.

Appendix 20.1

Not Used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 21

Environment

Table of Contents

21.1	General Environmental Requirements	1
21.2	Glossary	1
21.3	Environmental Staffing	1
21.4	Environmental Management	2
21.5	Sustainable Design Principles	6
21.6	Considerate Constructors Scheme	7
21.7	Dust and Air Quality	7
21.8	Noise and Vibration	8
21.9	Contaminated Land	10
21.10	Resource Use and Waste Management	11
21.11	Water	13
21.12	Ecology	14
21.13	Historic Environment	16
21.14	Highways and Traffic	16
21.15	Construction Worker Travel	17
21.16	Lighting	17
21.17	Site Energy Conservation	17
21.18	Documentation Submission and Acceptance	17
21.19	Corporate and Mayoral Requirements	18
21.20	Compliance Obligations	18
Appendix 21.1	Corporate Environment Framework	19
Appendix 21.2	Environmental Data	20
Appendix 21.3	Sustainable Urban Drainage Systems (SuDS)	22
Appendix 21.4	Example Section 61	23

21.1 General Environmental Requirements.

This document contains the environmental and sustainability requirements that the *Contractor* shall adhere to at all times when undertaking the *works*.

Where there is a requirement for the *Contractor* to submit documentation to the *Project Manager* (e.g. plans and reports), all such documentation shall be submitted for the *Project Manager's* acceptance. A reason for the *Project Manager* not accepting documentation is that it does not comply with the Works Information.

If the *Project Manager's* acceptance is not provided, the *Contractor* shall revise and resubmit the documentation to the *Project Manager* until such time as acceptance is granted. After which, the *Contractor* shall comply with the accepted documentation.

21.2 Glossary

Term	Definition
Environmental Management System	LUL's Environmental Management System 'Standards'
HSE	Health Safety and Environment

21.3 Environmental Staffing

21.3.1 Environmental Lead

As a minimum, the *Contractor* shall ensure that a suitably competent and experienced person is appointed to lead on environmental and sustainability matters and ensure the full implementation of all the requirements contained herein. The person must be able to demonstrate the attainment of suitable environmental qualifications (e.g. completion of the IEMA Foundation in Environmental Management, or a similar course)

21.3.2 Other Environmental Specialists

As necessary, based on the scope and the level of environmental risk associated with the *works*, the *Contractor* shall engage environmental specialists to ensure the full implementation of the environmental requirements. The environmental specialists may include personnel with expertise in noise/vibration, air quality, ecology, contaminated land, etc.

All such specialists shall have suitable qualifications and experience.

21.3.3 Written Consent

The *Contractor* shall obtain the *Project Manager's* written consent before the proposed personnel take up any environmental or sustainability related positions, and prior to implementing any changes to the personnel undertaking these roles.

21.4 Environmental Management

21.4.1 Environmental Management Plan

The *Contractor* shall define their Environmental Management System (EMS) approach within a site specific Environmental Management Plan (EMP).

The EMP shall be based on the requirements of the latest BS EN ISO 14001 standard, and shall include coverage of each of the environmental aspects referenced in this document – although coverage may be suitably scaled to the project's level of environmental risk.

The EMP shall cover all stages of the *works*, including the design stage, where applicable.

As a minimum, the EMP shall include or define the approach to:

- Planning – determining the project specific risks and opportunities and actions to address significant environmental aspects and fulfil all compliance obligations.
- Environmental objectives – establishing environmental objectives and plans to achieve them
- Operational planning and control – establishing and implementing processes to manage the identified environmental risks and fulfil all compliance obligations, objectives etc.
- Emergency preparedness and response – detailing the processes to prepare for and respond to emergency situations
- Performance evaluation – detailing the approach to monitoring, analysing and evaluating environmental performance, including how the Works will be monitored and inspected
- Internal Audit – the approach to establishing and implementing an internal audit programme
- Management review – how top management will review the EMS to ensure its continuing suitability and effectiveness
- Improvement – Approach to dealing with nonconformities and correctives actions

The *Contractor* shall submit their EMP to the *Project Manager* for acceptance within twenty-eight (28) days of the starting date.

Works shall not start on site until the *Project Manager* has accepted the EMP. A reason for the *Project Manager* not accepting the EMP is that it does not comply with the Works Information

The *Contractor* shall comply with the accepted EMP at all times.

21.4.2 Environmental Targets

As a minimum, the *Contractor* shall adopt the following environmental targets and put in place appropriate systems to achieve them.

Description	Target
Environmental enforcement/regulatory notices	0
Major environmental incidents	0
Percentage of non-hazardous construction and demolition waste diverted from landfill (i.e. reused, recycled and/or recovered)	Refer to yearly targets in table below
Percentage of non-hazardous construction and demolition waste recycled	70%
Percentage of non-hazardous excavated materials diverted from landfill	99%
Recycled content of steel purchased	25%
Recycled content of concrete / cementitious materials purchased	25%
Timber used and purchased from sustainable sources	100%

TfL Group has a target to divert (i.e. reuse, recycle and/or recover) 99% of non-hazardous waste from landfill by 2031. To assist us meet this target, the *Contractor* shall adopt the following targets for diverting non-hazardous construction and demolition waste from landfill by the years indicated.

Year	2018-20	2021-25	2026-30	2030
Percentage of non-hazardous construction and demolition waste diverted from landfill	96%	97%	98%	99%

The *Contractor* may propose additional environmental objectives to either take account of the identified significant environmental aspects or compliance obligations, or to support the attainment of the objectives in TfL's Corporate Environment Framework (Appendix 21.1), or their own corporate goals.

The *Contractor* shall report on progress against all environmental targets within the period progress report – including justification and / or proposals for achieving the target if it is not being met.

21.4.3 Environmental Reporting

The *Contractor* shall report the following information as part of their period progress report, or via the Info Exchange Online Portal (when available).

- The Environmental Data as set out in Appendix 21.2
- Details of any environmental incidents or near misses that occurred and, how the issue was resolved (i.e. what corrective action was implemented)
- Details of any interaction with environmental regulators

21.4.4 Environmental Inspections and Audits

The *Contractor* shall implement a programme of environmental inspections and audits to ensure compliance with all legal and contract requirements (Compliance Obligations).

The *Contractor* shall keep the *Project Manager* apprised of the timing of these environmental inspections and audits, so that a member of the TfL HSE Team may, on occasions, attend and participate in joint exercises.

21.4.5 Competency and Training

The *Contractor* shall determine the environmental competency and training requirements for all staff working on the project, and maintain documentation to demonstrate delivery of the planned training.

As a minimum, the *Contractor* shall ensure that all staff receive environmental awareness training on the specific project risks and the content of the EMP.

21.4.6 Emergency Preparedness and Response

As a minimum, the *Contractor* shall define the following either within their EMP or an Emergency Preparedness Plan:

- Definitions of what constitutes an environmental incident, a major environmental incident, an environmental emergency, harm or damage to the environment, and an environmental near miss;
- Details of the potential types of environmental incident relevant to the works and the envisaged control measures;
- Responsibilities of the *Contractor's* staff for dealing with an environmental incident or near miss;
- Details of the incident response equipment that will be used to bring environmental incidents or emergencies under control, including the location of spill kits and the minimum acceptable stock requirements;
- An up-to-date site drainage plan which details manholes, direction of flow, interventions points and final discharge points to foul and surface water resources;
- The systems (and contact details) for notifying the appropriate statutory authorities, emergency services, *Project Manager* and the *Contractor's* personnel in the event of an environmental incident or near miss;

- Contact details of a supplier who can assist if the incident cannot be dealt with by the *Contractor's* team (e.g. if a significant spill occurs that cannot be controlled or cleaned up by the site staff)
- The information to be recorded in the event of an environmental incident (to include date, time, location, description of incident, action taken, personnel involved and notifications, photographs); and,
- A simple flowchart to show the process and responsibilities.

21.4.7 Investigation of Environmental Incidents

The *Contractor* shall notify the *Project Manager* of all environmental incidents and 'near misses' as soon as practicable after they occur. In particular, the *Contractor* shall ensure that any incidents which could result in significant damage to the environment, a breach of legislation, or reputational damage are reported to the *Project Manager* immediately.

All environmental incidents and/or near misses shall also be reported to via the TfL Incident Line or the Info Exchange Online portal as soon as possible but within twenty-four (24) hours of the event occurring.

In the event of any environmental incident or near miss, the *Contractor* shall record the following information and ensure it is reported to the *Project Manager* within an initial written report which shall be submitted within forty eight (48) hours of the incident occurring:

- Time and date;
- Location of incident;
- Description of incident – including an outline of events, personnel and parties involved and any mitigation measures applied;
- Whether the incident is considered an environmental incident, a major environmental incident, an environmental emergency or an environmental near miss;
- In the event of a spillage, details of the substance spilt and an estimate of the amount;
- An initial assessment of the root causes of the incident and any corrective actions proposed to prevent recurrence

In order to fully identify root causes and prevent recurrence, all environmental incidents and near misses shall be investigated by the *Contractor*. The *Contractor* shall produce a report of the investigation and shall submit this to the *Project Manager* within fourteen (14) Working Days of the incident.

In addition to containing the bullet point information above, the report shall, as a minimum, include:

- Photographs / a sketch showing what happened and where;
- Details of any notification/third party involvement;
- Immediate causes;

- Root causes – e.g. inadequate procedures, conflicting targets, poor communication, lack of training, inadequate maintenance, extreme weather conditions or lack of security;
- Remedial actions implemented and/or proposed and timescales; and
- Measures to prevent recurrence and timescales.
- Approvals by the *Contractor's* senior individual responsible for ensuring the actions are completed satisfactorily.

The *Contractor* shall monitor the implementation of any actions / recommendations resulting from the investigation of the environmental incident, and shall ensure that they are completed by the scheduled completion dates.

21.4.8 Advanced Notifications

The *Contractor* shall take a pro-active approach to notifying residents, businesses and regulators (e.g. the Local Authority) about forthcoming works that may impact upon them – including the removal of vegetation or the undertaking of 'noisy' or 'out-of-hours' works. The notifications, which shall be made using a format agreed with the Project Manager, shall, as far as possible, be issued two weeks prior to the works taking place.

As a minimum, the notifications shall include:

- Details of the works to be undertaken
- The dates / hours of working
- Brief details of the potential impacts and how these are to be mitigated
- Contact details that can be used to seek further information or make a complaint

TfL Group operates a twenty-four (24) hours hotline (0343 222 2424) which customers can use to make complaints. Alternatively, customers can email contactus@tfl.gov.uk

21.4.9 Environmental Correspondence

The *Contractor* shall provide the *Project Manager* with a copy of all environmentally related correspondence with third parties (e.g. the Local Authority or Environment Agency) on the date of issue.

21.5 Sustainable Design Principles

21.5.1 Reduction of whole life carbon, water usage and cost

Where the *Contractor* is responsible for the design, the *Contractor* shall strive to lower the project's whole life carbon and whole life cost by investigating, and where practicable implementing, innovative sustainable design and construction solutions.

For example, the *Contractor* shall:

- Use principles that consider the longer-term design life of assets and that will offer solutions that remain state of the art.

- Design systems, and install equipment that will reduce energy use and the asset's operational cost.
- Where replacing assets, ensure that more energy efficient equipment replaces that which currently exists. The Contractor shall notify the Employer where this is not technically feasible, e.g. heritage feature.
- Design systems, and install equipment that minimises water use during the asset's life.

Additionally, the *Contractor* shall, wherever possible, purchase and install products that qualify for the government's Enhanced Capital Allowance scheme by choosing plant and equipment from the Energy Technology List and Water Technology List.

21.5.2 Minimising Noise and Vibration in design

Where the *Contractor* is responsible for developing designs that could give rise to noise or vibration impacts from TfL Group and Network Rail owned operational assets, the *Contractor* shall ensure that the assets or systems are designed to meet the noise and / or vibration criteria in TfL Guidance Document G1323 Noise and vibration asset design.

21.5.3 Green Infrastructure

The Mayor's aspirations for promoting green infrastructure are set out in the London Plan and the London Environment Strategy. The *Contractor* shall support delivery of these aims by incorporating green infrastructure (including Sustainable Urban Drainage Systems (SuDS)) into the project wherever feasible. Refer to Appendix 21.3.

21.6 Considerate Constructors Scheme

21.6.1 The *Contractor*, its subcontractors, suppliers and the site shall be registered with the Considerate Constructors Scheme. <https://www.ccscheme.org.uk/>

21.6.2 The *Contractor* shall actively implement the code of considerate practice and shall participate and promote best practice initiatives in Providing the Works.

21.7 Dust and Air Quality

21.7.1 Impact Mitigation

The *Contractor* shall ensure that air quality impacts (including dust) from demolition, construction-related activities and construction traffic are controlled by using best practicable means during the planning and management of the Works.

The *Contractor* shall ensure compliance with the Mayor of London's Supplementary Planning Guidance (SPG) on The Control of Dust and Emissions During Construction and Demolition. Refer to: <https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/planning-guidance-and-practice-notes/control-dust-and>

21.7.2 NRMM

All of the *Contractor's* non-road mobile machinery (NRMM) between 19kW and 560kW and must meet or exceed the following requirements (which are more stringent than stated in the SPG):

- NRMM used on any site within Greater London shall, as a minimum, meet Stage IIIB of EU Directive 97/68/EC (as amended) emission standards.

- From 1 September 2020, NRMM used on any site within Greater London shall, as a minimum, meet Stage IV of EU Directive 97/68/EC (as amended) emission standards.

All NRMM must meet the above standards unless it can be demonstrated that the machinery is not available or that a comprehensive retrofit to meet PM10 and NOx emission standards is not feasible. In this situation, every effort must be made to use the least polluting equipment available (next best available EU stage) including retrofitting technologies to reduce particulate emissions.

Where applicable, the *Contractor* shall comply with the Greater London Authority's (GLA) NRMM Exemption policy for any NRMM, which cannot meet the emissions requirements. Details can be found at <http://nrmm.london/>. The *Contractor* shall seek exemption from the *Project Manager* for any NRMM of net power between 19 and 36 kW that cannot comply with the emissions standards.

The *Contractor* shall also:

- Maintain an inventory of all on-site NRMM using the GLA's nrmm.london database.
- Regularly service all machinery and keep records on site.

21.8 Noise and Vibration

21.8.1 Impact Mitigation

The *Contractor* shall use best practicable means to reduce noise and vibration at all times, and shall comply with the provisions of the current edition of BS5228 - Code of Practice for Noise and Vibration Control on Construction and Demolition Sites.

21.8.2 Working Hours

As far as reasonably practicable and where applicable, the *Contractor* shall undertake all works within the following core working hours:

- 0800 to 1800 on weekdays (excluding public and/or bank holidays),
- 0800 to 1300 on Saturdays

It is acknowledged that elements of the *works* may need to be undertaken outside of core working hours – e.g. during highway or railway possessions / blockades. In accordance with best practicable means, the *Contractor* shall programme the *works* so that any activities with the potential to give rise to disturbance are undertaken during less sensitive times of the day (i.e. avoiding night-time if possible).

Work outside of normal working hours must be agreed with the *Project Manager* and the Local Authority before being undertaken.

If 'out of hours' works are to be undertaken, the *Contractor* shall notify local residents or other sensitive receptors in advance of commencing the works.

21.8.3 Section 61 Consents

Unless the *Contractor* can demonstrate to the *Project Manager* that the works can be undertaken without the risk of disturbing local residents or other noise and/or vibration sensitive receptors, the *Contractor* shall seek and obtain a consent under Section 61 of the Control of Pollution Act, 1974, for all works (a Section 61 consent).

No works shall be undertaken in advance of obtaining a Section 61 consent, unless explicitly agreed in advance with the *Project Manager*.

The *Contractor* shall develop a draft Section 61 consent application (prepared by competent acoustic professionals) and agree this with the *Project Manager* before submitting it to the Local Authority. Refer to Appendix 21.4 – Example Section 61

If the *Contractor* is to seek consent for working outside of the core working hours, then the *Contractor* shall provide justification for doing so, and detailed assessment of the associated noise impacts.

The *Contractor* is advised that the Local Authority can take up to twenty-eight (28) days to determine a Section 61 application. In addition, the *Project Manager* requires that a draft of the Section 61 application is submitted for review at least seven (7) days prior to submission to the Local Authority, and that the *Contractor* addresses any comments raised by the *Project Manager* prior to submission to the Local Authority. The *Contractor* shall allow for the above timescales in their programme.

No works covered by a Section 61 application (or subsequent variation / dispensation) shall be commenced until the *Contractor* has obtained the relevant consent from the Local Authority

The *Contractor* shall comply with the Section 61 consent at all times.

If the *Contractor* wishes to seek agreement from the *Project Manager* that a Section 61 Consent is not required, they shall submit justification to the *Project Manager* which shall include details and reasoning based on the following:

- the nature of the works being undertaken,
- the time of day the works will be undertaken,
- the duration of the *works*,
- the proximity of neighbours,
- the sensitivity of neighbours (e.g. residents, schools, hospitals, places of worship etc. would likely be considered more sensitive to noise than industrial areas).

The *Contractor* shall ensure that all Section 61 consent related correspondence with the Local Authority is copied to the *Project Manager*. This shall include provision of all applications for, or variations / dispensations to, a consent, all consents granted by the Local Authority, all over-run notifications and any associated matters.

21.8.4 Noise and Vibration Monitoring

The *Contractor* shall undertake any monitoring required by the Section 61 Consent.

Unless the *Contractor* can demonstrate to the *Project Manager's* satisfaction that monitoring is not required, the *Contractor* shall, as a minimum, undertake noise monitoring adjacent to the closest noise sensitive receptors (e.g. residential premises) at the start of each new phase of works, and if undertaking any works outside of core working hours.

The monitoring shall be undertaken for a minimum of ten (10) minutes at each location, and shall, as a minimum, record the LAeq over this time period, together with notes on the dominant noise sources and the calibration levels at the beginning and end of the measurement period.

The *Contractor* shall also undertake noise or vibration monitoring in response to any complaints, or requests from the *Project Manager* or the Local Authority.

All noise monitoring will be undertaken using type 1 noise monitors which comply with BS EN 61672-1:2003.

The noise monitoring data shall be submitted to the *Project Manager* for information. This information shall be submitted at a minimum frequency of once a month.

The *Contractor* shall also undertake regular on-site checks to confirm the application of BPM and adherence to the Section 61 consent requirements.

21.9 Contaminated Land

21.9.1 General

The *Contractor* shall comply with all relevant statutory and industry best practice guidance related to the assessment and management of contaminated land.

Prior to commencing the *works*, the *Contractor* shall identify any areas of potential contaminated land. Where there is the potential for the works to impact on, or be impacted by, potentially contaminated land, the *Contractor* shall develop and implement any necessary mitigation measures or remediation proposals.

Such proposals, which shall comply with statutory guidance and industry best practice, shall be submitted to the *Project Manager* for acceptance. Landfill shall only be used if other remediation options (e.g. on-site treatment, off site treatment) are not reasonably practicable.

The *Contractor* shall plan and undertake the *works* in a manner which minimises the disturbance of any contaminated land and avoids the creation of pollution pathways.

The *Contractor* shall monitor excavation activities to check for unexpected or unusual materials which may constitute contaminated land. In the event of such a discovery, the *Contractor* shall inform the *Project Manager* as soon as practicable. The *Contractor* shall implement all reasonably practicable measures to ensure the unexpected contaminated land does not give rise to risks to human health and the environment.

The *Contractor* shall develop and implement measures to deal with the unexpected contaminated land after obtaining the *Project Manager's* acceptance of the proposals.

21.9.2 Asbestos

If ground containing asbestos is encountered during the *works*, the *Contractor* shall stop the activity in question. Work on the activity shall not restart until the *Contractor* has developed appropriate proposals to minimise the risk to the workforce and other potential receptors. The proposals developed by the *Contractor* shall comply with all relevant statutory guidance and controls and the *Contractor* shall undertake the works in compliance with the proposals at all times.

The removal of asbestos will be undertaken by a suitability licensed asbestos removal contractor and managed in accordance with the relevant statutory controls.

21.9.3 Import of soils or infill materials

The *Contractor* shall not bring soils or infill materials onto the site unless they have been satisfactorily proven to be uncontaminated and to present no risks to human health, property or the environment. Documentary evidence to confirm the origin of all imported soils and infill materials, supported by appropriate chemical analysis test results, shall be maintained by the *Contractor*.

21.10 Resource Use and Waste Management

21.10.1 Introduction

The *Contractor* shall take a proactive approach to the sustainable use of resources and to minimising both the production of waste and the volume of waste disposed of in landfill.

21.10.2 Resource Efficiency

The *Contractor* shall implement material efficiency principles wherever practicable by, for example:

- using less materials,
- adopting low-waste processes,
- using recycled materials or by-products from other industries in preference to virgin materials,
- using durable materials to extend the asset's serviceable life.

The *Contractor* shall consider the properties and potential environmental impacts of materials and shall select and use materials which have a low or reduced environmental impact – e.g. materials that are:

- non-hazardous (environmentally inert),
- low VOC,
- recyclable,
- low(er) in embodied energy and/or water.

The *Contractor* shall document how they have met the above requirements within a Resource and Waste Management Plan (RWMP).

The *Contractor* shall also endeavour to procure products and materials responsibly. Principles for achieving this are set out within the GLA's Responsible Procurement Policy, and products or materials certified under the BRE's Responsible Sourcing Standard, BES6001 are deemed to meet the Standard's responsible sourcing requirements.

21.10.3 Timber

Where it is necessary to use timber, the *Contractor* shall ensure that only timber from recycled, reclaimed or sustainable sources (i.e. timber sourced in accordance with the UK Government's Timber Procurement Policy or accredited to the Forest Stewardship Council (FSC) or an equivalent scheme) is incorporated into the temporary and permanent works.

21.10.4 Waste Management

All wastes shall be managed in accordance with the waste hierarchy. For each waste type, the *Contractor* shall therefore adopt and implement the highest option for managing waste from the list below:

- prevent
- reduce
- re-use within the project
- re-use at other project sites
- recycle
- recover, e.g. energy from incineration
- dispose

21.10.5 Construction Phase Resource and Waste Management Plan

The *Contractor* shall build upon the RWMP compiled during the design stage to develop and implement a Construction Phase Resource and Waste Management Plan that delivers the aspiration of the design stage RWMP, and, as far as practicable, ensures:

- compliance with the resources, materials and waste requirements
- compliance with the waste duty of care
- achievement of project waste and/or materials targets

The *Contractor* shall develop the Construction Phase RWMP prior to commencing the works on-site.

The *Contractor* shall not commence works until the *Project Manager* has accepted the Construction Phase RWMP. A reason for the *Project Manager* not accepting the RWMP is that it does not comply with the Works Information.

The *Contractor* shall regularly review and as necessary, update the Construction Phase RWMP to take account of changing circumstances. Such reviews shall take place at least every six (6) months during construction (unless otherwise agreed with the Project Manager). The updated Construction Phase RWMP shall be submitted to the Project Manager for acceptance.

The *Contractor* is encouraged to use the Electronic Duty of Care (EDOC) system.

21.11 Water

21.11.1 The *Contractor* shall undertake the *works* in a manner which protects the water environment – including any change to water quality, flow volume or levels.

To achieve this, the *Contractor* shall, as a minimum:

- Identify any water sensitive receptors (such as ponds, watercourses, drains or groundwater) which may potentially be affected by the Works, and assess the risk to them;
- Identify any mitigation measures which shall be employed to minimise the risk to these water sensitive receptors – including any necessary pollution prevention measures;
- Obtain and comply with any necessary abstraction, discharge and other water environment consents;
- Undertake any water quality monitoring programmes agreed with the *Project Manager*.

The output of the *Contractor's* risk assessment and the identification of mitigation measures shall be clearly documented – e.g. within the Contractor's EMP.

As a minimum, the *Contractor* shall ensure that:

- All potentially polluting materials, plant and equipment is stored away from water sensitive receptors, including drains;
- All containers of potentially contaminating substances are securely stored within impermeable bunds with a capacity of not less than 110% of the largest container or 25% of the aggregate total capacity of the containers, whichever is the greater;
- All refuelling, oiling or greasing is undertaken on impermeable surfaces or using 'plant nappies';
- An authorised person oversees the bulk delivery of fuel to the site, and the refuelling of vehicles, plant and equipment;
- Plant, equipment and vehicles are regularly inspected and maintained to ensure they are free from oil and fuel leaks;
- Measures are implemented to prevent run-off and other pollutants being washed into watercourses;
- Where wheel washes are installed adjacent to site accesses or egresses, they are self-contained, recycle as much wash water as possible and will not directly discharge to the environment;

- Sufficient quantities of spill kit materials are available and that personnel are trained in their use;
- All spillage incidents are reported and investigated so that lessons can be learnt and, if required, further controls can be implemented to prevent further potentially more serious incidents.

The *Contractor* shall avoid the use of drip trays (due to their propensity to fill with water which can either overflow or be spilt). Instead, the *Contractor* shall use 'plant nappies' under plant etc. to contain any drips or spillages.

The *Contractor* shall use water in an efficient manner, both on-site and within site accommodation.

The *Contractor* shall not make temporary or permanent connections to any mains, drains, pipes, watercourses or utility services without the necessary consent.

21.12 Ecology

21.12.1 Introduction

When developing and implementing the *works*, the *Contractor* shall ensure that due consideration is given to ecology and biodiversity in line with current legislation and applicable strategies and plans. The mitigation hierarchy (of avoid, minimise, restore, compensate) shall be followed, and a net gain in biodiversity shall be delivered, in accordance with Mayor's Transport Strategy.

Prior to commencing any works on-site, the *Contractor* shall review the ecological information that is available to determine if it is sufficient and current enough for the risks and opportunities to be understood.

If the *Contractor* deems the available information to be insufficient or out-dated, the *Contractor* shall arrange for a suitably competent Ecologist to undertake any ecology surveys necessary to inform the *Contractor* about the potentially affected habitats and the presence of protected species, or to comply with the survey recommendations from previous reports.

The report must be prepared in sufficient time to enable the *Contractor* to implement the recommendations before the commencement of any works on site with the potential to affect ecological resources.

Works shall not start on site until the *Project Manager* has accepted the Ecologist's report. A reason for the *Project Manager* not accepting the Ecologist's report is that it does not comply with the Works Information.

When undertaking the *works*, the *Contractor* shall adhere to all the recommendations in the Ecologist's report. In addition, they shall comply with any applicable legislation, Mayoral policies, TfL Group strategies, borough biodiversity plans, guidance or code of practice.

In the event that the *works* disturb, or have potential to harm, wildlife on-site, the *Contractor* shall immediately cease the offending works and inform the *Project Manager* of the issue and the proposals for rectifying / avoiding further impacts.

21.12.2 Trees

The *Contractor* shall take all reasonably practicable measures to minimise the loss of trees.

Should remedial or protective works to trees on, or adjacent to, the worksite be required, the *Contractor* shall employ a suitably trained and qualified arboriculturalist to advise and/or carry out the works in accordance with the latest version of:

- BS 5387 “Guide for trees in relation to construction” and
- BS 3998 “Tree work – recommendations”
- NJUG vol 4 “NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees”

Prior to undertaking any *works* which may affect a tree, the *Contractor* shall confirm, with the Local Authority, whether it is protected by a Tree Protection Order (TPO), or is within a conservation area. If a TPO is in place, or the tree is protected by virtue of being in a conservation area, the *Contractor* shall ensure that consent is obtained from the Local Planning Authority prior to undertaking any *works* that may affect the tree.

21.12.3 Nesting Birds

The *Contractor* shall implement the following control measures:

- Where possible, any clearance of scrubs and/or trees shall be undertaken outside of the peak nesting bird season (typically March to August inclusive).
- If clearance of scrubs and/or trees or other works affecting structures with the potential for nesting birds is required during the breeding season, the *Contractor* shall engage a suitably qualified ecologist to undertake checks prior to these works to ensure nesting birds are not affected. If nesting birds are found, the area must be left until the birds have fledged, as is required by the legislation.

21.12.4 Invasive Species

If any invasive weeds may be affected by the *works*, the *Contractor* shall develop and, once agreed with the *Project Manager*, implement proposals for controlling these plants and ensuring they are not spread by the *works*.

21.12.5 Biosecurity

Where landscaping is included within the scope of *works*, the *Contractor* shall ensure the use of UK grown trees, shrubs and other bedding plants in order to maintain biosecurity.

If there is a justifiable reason why UK grown plants cannot be used and plants need to be imported, the *Contractor* shall ensure that the plants have undergone a quarantine period appropriate to the species prior to being purchased.

The *Contractor* shall provide the *Project Manager* with suitable documentary evidence to confirm these requirements prior to installation.

21.12.6 Ecological and biodiversity data

All background ecology data searches, necessary to complete required ecology surveys, must be sourced from the Greenspace Information for Greater London CIC (GiGL) (the local environmental records centre for London) under the TfL Service Level Agreement; using the GiGL TfL data search request form: <https://www.gigl.org.uk/data-insight-services/transport-for-london/>

To enable TfL to maintain datasets for the TfL estate, the Contractor must return all ecology data and biodiversity net gain data, including GIS layers, to GiGL following the How to Provide Data guidance How to Provide Data guidance: <https://www.gigl.org.uk/data-insight-services/transport-for-london/>

Ecology data must be returned within eight (8) weeks of each survey completion. Updated biodiversity Net gain data must be returned once work on site is complete.

21.13 Historic Environment

Where there is the potential for the *works* to affect heritage assets or archaeology, the *Contractor* shall ensure that suitable procedures are developed for mitigating and managing the potential effects. The procedures, which may be within the EMP or a stand-alone document, shall be agreed with the *Project Manager*.

21.14 Highways and Traffic

The *Contractor* shall undertake any necessary consultation with the Highways Authority for works affecting public highways, and shall ensure that all necessary consents or licences are obtained and complied with.

When undertaking works that affects the highway, the Contractor shall:

- minimise the need for and duration of any closures or diversions of highways or public rights of way
- where necessary, provide and maintain suitable diversion routes with all necessary signage and barriers, and
- provide advanced notification to all potentially affected local residents and businesses about the diversion routes and dates / durations of use.

The *Contractor* shall minimise the impacts of construction traffic on the public highways and access routes by:

- Consolidating loads to reduce the number of deliveries
- Planning delivery routes and times to avoid sensitive sites / activities – e.g. schools at the start or end of the school day
- Implementing measures to prevent the deposition of mud on roads - these may include: the provision of hardstandings and wheel cleaning facilities at access points, the sheeting of lorries, and/or the use of mechanical road sweepers
- Avoiding, wherever practicable, the parking of vehicles on public highways
- Ensuring vehicles are switch off when not in use

21.15 Construction Worker Travel

The *Contractor* shall implement measures to encourage site staff and construction workers to avoid using private cars to access the work site, and to encourage them to use alternatives such as public transport, cycling, walking etc. The *Contractor* shall monitor the effectiveness of the proposed measures.

21.16 Lighting

The *Contractor* shall take all reasonable steps to minimise the potential for artificial light to adversely affect or intrude upon local sensitive receptors. This shall include, but not be limited to:

- Avoiding or minimising the use of lighting
- Using the appropriate lux levels to minimise disturbance
- Using directional lighting or shielding to avoid intrusion

21.17 Site Energy Conservation

The *Contractor* will maximise energy efficiency on site. The measures to be implemented shall be detailed in the EMP, but, as a minimum, the following measures shall be considered and implemented wherever possible:

- Avoiding unnecessary day and night time lighting of the site, and offices / accommodation
- Installing energy efficient security and task lighting, e.g. LED;
- Providing well insulated site accommodation;
- Selecting and using energy efficient plant and equipment;
- Powering-down equipment/plant when not in use;
- Minimising the use of diesel or petrol powered generators and instead using mains electricity or battery powered equipment; and
- Collecting energy and fuel consumption data to communicate to staff and report to the *Project Manager*.

21.18 Documentation Submission and Acceptance.

- (a) There are a number of requirements for the *Contractor* to submit documentation to the *Project Manager* (e.g. Plans and Reports). All such documentation shall be submitted for the *Project Manager's* acceptance. A reason for the *Project Manager* not accepting the documentation does not comply with the Works Information.
- (b) If the *Project Manager's* acceptance is not provided, the *Contractor* shall revise and resubmit the documentation to the *Project Manager* until such time as acceptance is granted. After which, the *Contractor* shall comply with the accepted documentation.

21.19 Corporate and Mayoral Requirements.

- (a) The *Employer* has developed a Corporate Environment Framework (Appendix 21.1) that sets out the *Employer's* vision and ambition for environmental performance. The Framework details the *Employer's* priorities and explains how they will be delivered in a way that meets stakeholders' needs by achieving a range of objectives and targets.
- (b) The *Contractor* shall familiarise themselves with the content of the Framework and, where relevant, assist the *Employer* with the delivery of the commitments contained therein.
- (c) The *Contractor* shall also ensure that they take account of any applicable policies and proposals in relevant Mayoral documents - including the Mayor's Transport Strategy, Environment Strategy, Responsible Procurement Strategy, and the Sustainable Design and Construction supplementary planning guidance to the London Plan.

21.20 Compliance Obligations.

- (a) The *Contractor* shall identify all environmental or sustainability related compliance obligations that are applicable to the *works*. These compliance obligations shall be taken into account when establishing, implementing, maintaining and continually improving the *Contractor's* Environmental Management System.

Appendix 21.1: Corporate Environment Framework

Refer to pdf. document titled: "Appendix_21.1_TfL_Corporate_Environment_Framework"

How to interpret the results

The Check will produce a percentage score against each of the 10 Healthy Streets Indicators. These percentage scores give a general picture of how a design, in the round, is delivering against the 10 Healthy Streets Indicators. Designers should seek to increase the Healthy Streets Indicators scores.

An overall percentage score is also presented. This is not an average of the scores for each Indicator as each metrics contribute to multiple Indicators scores.

It is not possible to score a perfect 100% in any one design because compromises and trade-offs inevitably need to be made. The overall percentage score is less important than eliminating critical issues and delivering a rounded design.

The objective therefore is to get as high a score as possible, for this to be as evenly distributed across the 10 Indicators as possible and for '0' scores to be eliminated. A proposed scheme should also aim to deliver a score increase from baseline for all Healthy Streets Indicators' scores.

If any metrics have scored '0' these will be flagged up in the summary graph above and if they cannot be reconciled a justification for the decision to leave them in the design should be written in the text box below the scoring table.

There is no threshold score for a Healthy Street. Streets are not either 'healthy' or 'unhealthy' - some designs will perform better than others against the 10 Healthy Streets Indicators which may reflect physical, financial or political constraints on the project.

What the numbers mean

The Healthy Streets Check is not a scientific assessment of how healthy a street is. It is not the case that a street with a 10% increase in Healthy Streets Check score confers 10% greater health benefit to people who use it. It is also not the case that a 10% increase in Healthy Streets Check score will deliver a 10% uplift in active travel.

The metrics included in the Healthy Streets Check are the best available quantifiable and evidence based standards that are within the gift of the traffic engineer or urban designer to influence through the design of the street. As a result some of the Healthy Streets Indicators are linked to only a few metrics e.g. shade & shelter while others are linked to all 31 metrics e.g. pedestrians from all walks of life, because all the metrics contribute to the whole environment in the round and therefore affect the Indicator.

The numbers must therefore not be given any undue weight in the interpretation of the results. The objective is to get as high a score as possible for a given project, for this to be as evenly distributed across the 10 Indicators as possible and for '0' scores to be eliminated.

What '0' scores mean

Ten of the metrics can be scored '0'. All of these metrics are known high risk road danger issues. TfL is pursuing a Vision Zero target of zero deaths and serious injuries on the streets by 2041 which means that close consideration must be paid to ensure every opportunity to redesign our streets seeks to eliminate these known hazards.

Metrics scored '0' will be flagged in the final results if they have not been addressed . It is not always possible to improve '0' scores but it is important that these are identified through applying the Check and every effort has been made to find a design solution that can remove them.

Why you cannot get a perfect score

In a complex street environment a balanced approach must be taken; freeing up space for cycling or extending crossing times for pedestrians may produce delays for buses. Likewise removing a pinch point for cyclists or buses may mean removing an island refuge for pedestrians or from the reverse perspective installing an island refuge may introduce a pinch point for buses and cyclists. To be transparent and promote the best possible outcome in the round, recognising the difficult decisions designers

Appendix 21.4: Example Section 61

Refer to Word document titled: “Appendix_21.4_Example_Section_61_Form”

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 22

Quality Assurance

Table of Contents

22.1	General	1
22.2	Glossary	1
22.3	The Quality and Assurance Manager	3
22.4	The Quality and Assurance Manager Competency	4
22.5	Quality Management System	4
22.6	Assurance Requirements	5
22.7	Quality Requirements	5
22.8	Quality and Assurance Plans	6
22.9	Quality Audits	9
22.10	Inspection and Testing	10
Appendix 22.1 – Not Used		13

22.1 General

- 22.1.1 This Quality Assurance Works Information (CWI.22) defines the requirements that the *Contractor* shall comply with in the design, manufacture, installation, testing, commissioning, operation and maintenance of the *works*.
- 22.1.2 General quality requirements are defined in the QUENSH Conditions menu. Under the QUENSH Conditions section 53 relating to quality the *Contractor* shall work under a quality regime that is compliant with BS EN ISO 9001 as further set out below.
- 22.1.3 The *Contractor's* quality regime shall take account of and implement all other quality-related requirements when providing the *works*. The *Contractor* is encouraged to use its existing quality management processes and procedures to help meet the quality requirements.

22.2 Glossary

The terms and phrases defined in the below table apply to all elements of this Common Works Information (CWI 22).

Term	Definition
Assurance	Process of ensuring and providing evidence that the <i>works</i> have been designed and constructed in compliance with the <i>Employer's</i> Requirements.
Conformity	Fulfilment of specified requirements.
<i>Contractor's</i> Project Quality and Assurance Plan	A document setting out how the quality requirements of the contract will be achieved, controlled, assured, demonstrated and managed through use of existing management system processes.
<i>Contractor's</i> Quality and Assurance Management System	The management system for achieving the quality requirements described in the Works Information and for demonstrating that achievement, including the provision of documentary evidence and supporting records.
Control Procedure	Existing management system procedures which define the processes and controls used by the <i>Contractor</i> to in order to undertake a specific activity.
Corrective Action Request (CAR)	A statement prepared to record a failure to implement a specified process or contractual requirement. Generally identified during an audit.
<i>Employer's</i> Requirements	The output from the <i>works</i> in respect of spatial and operational improvements documented in the Works Information and TfL Standards and legislation applicable.
Hold Point	Mandatory verification point identified on Inspection and Test Plan (ITP) beyond which works must not proceed until an inspection is completed by an identified individual in order to confirm that specified requirements for an activity have been met. The identified authority is not necessarily a member of the client organisation. The client retains the right to attend and witness any activity.

Term	Definition
Inspection & Test Plans (ITPs)	Plans specifying the activities required to establish how Conformity is to be verified. They identify the responsibilities for executing the activities, the documents controlling them and the records required to provide Assurance. These are prepared for a particular element of the <i>works</i> to support the <i>Contractor's</i> Project Quality and Assurance Plan. For OPO CCTV these include as a minimum : a) Test, Inspection and Commissioning Strategy; b) Schedule of Tests and Inspections: and c) Testing and Inspection Programme.
Non Conformance Report (NCR)	A statement raised to record a Nonconformity (Defect) in the product, workmanship, or system.
Nonconformity	A Defect – Non fulfilment of a requirement.
Outstanding Work List	A list generated at an inspection or acceptance stage to identify Defects which must be remedied before an asset can be put into operational use.
Quality Control Procedures (QCPs)	Documents that specify operational techniques or activities that are used to fulfil requirements for quality, and as such support the contract quality plan.
Quality Focus Meeting (QFM)	Meeting with an agenda to reflect current, ongoing and emerging quality issues and to report any agreed Quality KPIs with an agenda to reflect current, ongoing and emerging quality issues and to report any agreed Quality KPIs.
Quality Improvement Plan (QIP)	A QIP is a process that should be used by the <i>Contractor</i> when the contract has a series of non-conformances that are of major concern. The QIP will focus on not just corrective actions but satisfying the <i>Project Manager</i> that the root cause has been addressed and future reoccurrence has been closed down. The QIP must be auditable in that it will show where process changes have taken place and relevant records can be seen.
Review Point	An identified point in Inspection and Test Plan (ITP) to review procedures, specifications and quality control records / reports as necessary to verify compliance with project Requirements. The reviewer is not necessarily a member of the client organisation. The client retains the right to attend and witness any activity.
Safe System of Work	A statement submitted describing how the <i>Contractor</i> plans to do the work, and identifying the principal Equipment and resources which he plans to use.
Site Query (SQ)	A request for information, clarification or agreement to a proposed action.
System Defect	A failure to comply with the quality and assurance management requirements specified in this Works Information.
Verification Activity Plan	Document prepared and owned by the <i>Employer</i> in accordance with TfL Standard S1538 Assurance.
Witness Point	Is an identified point in the process where the <i>Project Manager</i> may review, witness, inspect method or process of work. The activities however may proceed. This definition does not negate The Project Managers right to witness any activity.

22.3 The Quality and Assurance Manager

22.3.1 The *Contractor's* Quality and Assurance Manager will be dedicated to quality assurance matters for the *works* and shall have adequate resources and authority to ensure the quality of the *works* are managed effectively. The *Contractor* is responsible for ensuring the quality of any works, services or supplies required to deliver the *works* which are performed by his subcontractors and suppliers of any tier.

22.3.2 The Quality and Assurance Manager shall be independent of the design and construction functions, and shall have an independent link to the Project Director. The Quality and Assurance Manager shall be available for the entire duration of the *works*.

22.3.3 The Quality and Assurance Manager's general responsibilities include, but are not limited to:

- Developing and implementing a project Quality and Assurance Plan which is submitted to the *Project Manager* for acceptance;
- ensuring the *Contractor's* quality plan complies with BS ISO 10005, BS EN ISO 9001 and TfL Standard S1538 Assurance;
- developing and providing training on quality which shall be available to all *Contractor* and *Employer* personnel, including inductions and training for staff with specific quality responsibilities;
- managing all the *Contractor's* quality personnel;
- reviewing and approving the quality elements of the *Contractor's* Safe Systems of Work;
- ensuring compliance with legal and contractual requirements;
- providing advice and instruction to rapidly and effectively deal with quality non-conformities and/or complaints;
- Analysing individual quality non-conformities and complaints to identify trends, root causes and then proposes corrective and/or preventive actions needed. The *Contractor* shall capture these quality non-conformities and corrective/preventive actions in a register. The register shall be submitted to the *Project Manager* in six (6) month intervals from the *starting date* or at a frequency as requested by the *Project Manager*;
- Creating and sharing Quality Improvement Plans (QIP) with the *Project Manager* when there are root causes of significant concern. The QIP shall show what changes are needed to the *Contractor* and supply chain processes, resources and related ITPs to give confidence and assurance that the solutions will bring closure to a certain group of related non-conformances;
- ensuring that ITPs are completed progressively throughout the duration of the *works*;
- undertaking regular audits of the *Contractor*, Subcontractors (of any tier) and suppliers including ensuring compliance with all requirements;
- ensuring there is a robust assurance process which is documented in the Quality and Assurance Plan and that this process is effectively applied to achieve a 'right first time' ethos for process and product deliverables;

- Developing SMART (Specific, Measurable, Achievable, Realistic, Timed) sets of Quality KPIs for review and acceptance by the *Project Manager* within thirty (30) days of the starting date. These statistical measurements will be used to judge the ongoing levels of compliance against the requirements throughout the contract duration;
- Presenting the Quality KPI's at the periodic Quality Focus Meeting (QFM) discussing performance of ITP application, ongoing improvement targets for inspection failures and specific targets;
- Communication of the Quality KPIs to the wider team and Employer, with KPI's being a key agenda on the *Contractor's* internal reviews; and
- Convenes and chairs a periodic QFM with an agenda to reflect current, ongoing and emerging quality issues and to report any agreed Quality KPIs. Attendance at this meeting shall include, but is not limited to, the *Contractor's* Project Manager, Quality and Assurance Manager, Engineering Manager and any / all asset-specific personnel aligned to the activities determined by the programme. The QFM shall be formally recorded by the *Project Manager* and minutes distributed to attendees.

22.4 The Quality and Assurance Manager Competency

22.4.1 The Quality and Assurance Manager shall have the following key competencies:

- appropriate experience of quality management and the delivery functions of a contractor/supplier under self-certification contracts;
- good knowledge and practical experience of developing, implementing and improving quality management systems;
- be a member of the Chartered Quality Institute (or and equivalent recognised body) or an appropriate engineering institute; and
- be a competent quality auditor or shall have access to competent quality auditors.

22.5 Quality Management System

22.5.1 The *Contractor* and its subcontractors shall maintain a QMS that has been assessed by a UKAS accredited assessment organisation as meeting the requirements of BS EN ISO 9001. Should a further revision of BS EN ISO 9001 take place within the duration of the contract, the *Contractor* and its subcontractors will maintain its certification to the latest standard in accordance with the standard terms. The *Contractor's* QMS shall provide procedures for witnessing the manufacturing, construction, installation, testing and commissioning of the *works*.

22.5.2 The *Contractor* shall ensure that the *Employer* is made fully aware of any scopes of work that are required which fall outside the scope of their Management System which was certificated to BS EN ISO 9001. If this does occur it is imperative that this is covered in the *Contractor's* Project Quality and Assurance Plan and how such contract specific requirements will be managed as if subject to the requirements of ISO 9001.

22.5.3 Not Used

22.5.4 The *Contractor* shall develop the *Employer's* quality improvement initiatives, including but not limited to, key performance indicators to measure the effectiveness of selected processes.

22.5.5 The *Project Manager* may, at any time, notify the *Contractor* that its QMS is ineffective, for any reason including, but not limited to:

- non-conformances not being identified by the *Contractor* in a timely manner;
- non-conformances not being resolved in a timely manner;
- failure to prevent recurring non-conformances;
- consistent failure to provide required certification and records as work is executed;
- audits by the *Contractor*, the *Employer* or any other party identifying significant inadequacies in the QMS, which are considered to represent major risk;
- identified inadequacies in the QMS not being resolved in a timely manner; and
- consistent failure to meet to targets set within agreed KPIs.

Following notification by the *Project Manager* of an ineffective QMS, the *Contractor* shall develop a corrective action plan with the *Project Manager* and submit it for review and acceptance prior to implementation.

22.5.6 On-site and off-site laboratory tests shall be carried out by laboratories accredited by UKAS or by a similar, acceptable national body or by persons accredited to a similar standard, or as otherwise accepted by the *Project Manager*.

22.6 Assurance Requirements

22.6.1 The *Contractor* shall provide a Quality and Assurance Management System which meets the requirements of TfL Standard S1538 Assurance including appropriate quality management plans.

22.6.2 The systems identify how the *Contractor*, by audit, inspection, self-certification, collation and provision of evidence, demonstrates that the *works* are designed and constructed in compliance with all the requirements of the contract relevant standards and statutory regulations.

22.6.3 The *Contractor* submits plans and procedures for acceptance by the *Project Manager* to demonstrate how he will satisfy these requirements.

22.6.4 The *Contractor's* Quality and Assurance documentation shall be designed to minimise the duplication of information between plans and procedures.

22.7 Quality Requirements

22.7.1 The Contractor, his designers, Subcontractors and suppliers shall establish and implement quality management systems which comply with BS EN ISO 9001.

22.7.2 The *Contractor* shall provide access to its quality system documentation for review, inspection, and audit by the *Project Manager*, to support the requirements of the LUL Verification Activity Plan.

22.7.3 Any intervention by the *Project Manager* in Hold Point inspections, and critical interventions, in audits, or in the oversight of the progress of the *works*, does not relieve the *Contractor* of its obligations under the contract.

- 22.7.4 Quality system documentation which supports Subcontractor and supplier activities in the *works* is to be reviewed and approved by the *Contractor* before work starts on the relevant activities. All quality system documentation shall be made available to the *Project Manager* for audit upon request.
- 22.7.5 The *Employer*, the *Project Manager* and Others including statutory authorities and Statutory Undertakers have the right to observe, witness, conduct audits, inspections and tests of any *works* that are being executed by the *Contractor*, his designers, Subcontractors, suppliers and sub-tiers thereof.
- 22.7.6 The *Contractor* provides all inspection and testing necessary to demonstrate compliance with the specified requirements. All Non-conformances are resolved in accordance with the contract requirements.

22.8 Quality and Assurance Plans

- 22.8.1 The *Contractor* shall submit a Quality and Assurance Plan (QAP) for review within twenty (20) days of the Order Commencement Date. The QAP shall be subject to regular update by the *Contractor* as the works progress and at a frequency to be agreed with the *Project Manager*.
- 22.8.2 Following notification by the *Project Manager* of an ineffective QAP, the *Contractor* shall develop a corrective action plan to correct the ineffective elements of the QAP as identified by the *Project Manager*. The corrective action plan is submitted to the *Project Manager* for review and acceptance prior to implementation.
- 22.8.3 The QAP shall identify the extent that processes and supporting documentation are to be standardised across Subcontractors and sub-tiers thereof in order to provide a consistent approach and assurance that the requirements are being met.
- 22.8.4 The QAP shall, as a minimum, address the guidelines set out in BS EN ISO 10005 and:
- The quality requirements within TfL Standard S1552 Contract QUENSH Conditions;
 - cover the relevant phases of these *works* (design, procurement, manufacture, construction, installation, testing, commissioning and maintenance);
 - reference the mandatory procedures as listed in BS EN ISO 9001 and identify comprehensive quality system procedures that address the entire scope of the *works*;
 - describe the inter-relationship between partners' quality management systems in any joint venture or consortium (if applicable);
 - describe the relationships and activities of the *Contractor*, Subcontractors, suppliers and consultants including organisation charts;
 - specify the requirements of the QMSs to be operated by the Contractor's Subcontractor's suppliers and consultants and sub-tiers thereof;
 - indicate the inter-relationship of the QAP with other associated documentation of the *Contractor*;

- allow for audits to be carried out as required;
- identify comprehensive quality system audit procedures including the preparation of audit reports;
- identify procedures to rectify non-conformances raised. This includes systems non-conformances raised as a result of both internal and external audits;
- describe the statistical process techniques to prevent the occurrence of non-conformities;
- provide for regular management reviews of the QMS;
- identify the completion procedures which shall provide for review and verification of records by the *Contractor's* Quality and Assurance Manager;
- identify quality-related Key Performance Indicators;
- identify those Subcontractor and *Contractor* documents that are to be submitted for review and/or acceptance to the *Project Manager*;
- identify the *Contractor's* and Subcontractors' design control systems/procedures;
- identify the *Contractor's* and Subcontractors' testing and commissioning procedures; and
- identify the requirements for software assurance.

22.8.5 As required, the QAP is supported by documentation such as Control Procedures (CP's), inspection and test plans, method statements and TfL Standards. The responsibility for the review, compliance and/or approval of supporting documentation is with the *Contractor*. The *Project Manager* shall agree with the *Contractor* which documents require the *Project Managers* acceptance. The *Contractor* shall minimise the duplication of information contained in the various QMS documents and shall describe within the QAP the inter-relationship of all documents.

- 22.8.6 The primary activities addressed by CP's and to be prepared and implemented by the *Contractor* shall include, but are not limited to, the following:

ACTIVITY / ELEMENT
Design
- design control
- achievement of RAMS requirements
- configuration management
- systems engineering
- assurance
- Human Factors
- data preparation
Procurement
- monitoring the activities of consultants, Subcontractors and sub-tiers thereof, to ensure their compliance with these Implementation Works Terms
Manufacturing
- interim/routine inspection of work
- preparation review and approval of ITPs
- Type Test, Routine Test and factory acceptance test (FAT) certification
- inspection certificates
- delivery, handling and packaging
Installation
- material control
- receiving inspection
- interim/routine inspection of work including temporary <i>works</i>
- monitoring against method statements
Testing and Commissioning
- setting to work and the verification of Plant and Equipment and Materials and system compliance through conducting testing and commissioning;
- site acceptance testing
- certification control and co-ordination;
- handover certification
Technical Support
- control of changes such that they are incorporated into final records
Administration
- preparation of CPs and method statements and ITPs
- production of four-weekly reports of quality issues including non-conformity records, key performance indicators
- management of risk

ACTIVITY / ELEMENT
- communication and submissions to and from the <i>Employer</i>
- interface/boundary management during all phases
- health and safety file
Quality Assurance
- planning and conducting of audits, the reporting of results and the maintenance of records
- demonstrate that specified requirements have been met by checking, reviewing, inspecting and testing the <i>works</i> and producing appropriate records including "as-built" records
- critical items list
- product identification and traceability
- control of documentation and records
- collation of quality verification records during all phases
- control and calibration of measuring and test equipment
- accreditation including competency of personnel
- control identification, storage, retrieval, retention and disposition of records
- compliance with agreed work processes and procedures

22.8.7 The *Contractor* shall ensure that its Subcontractors shall perform the *works* in accordance with the QAP and CP's.

22.9 Quality Audits

22.9.1 The *Contractor* shall submit for acceptance to the *Project Manager* with each QAP, a consolidated schedule of internal, consultant and Subcontractor and sub-tiers thereof audits that are to be conducted by the *Contractor*. The schedule, scope and method of the audits shall enable the *Contractor* to verify that all aspects of the *works* are being conducted in accordance with the contract requirements.

22.9.2 A twelve (12) month rolling audit schedule and any amendments thereof shall be subject to acceptance by the *Project Manager*.

22.9.3 The *Contractor* shall allow the *Project Manager* to observe these audits and to conduct additional independent audits, as required, to provide assurance that the *works* are being conducted in accordance with the Works Information. The *Contractor* shall provide the facilities and access necessary for these audits to be carried out.

22.9.4 All audits performed by the *Contractor* and called for in this section shall be carried out as described in BS EN ISO 19011 and a complete copy of all audit reports shall be submitted to the *Project Manager*.

- 22.9.5 The *Contractor* shall maintain an audit / Corrective Action Request (CAR) database. The Contractor shall actively manage and update the CAR database including:
- Monitoring all NCRs and CARs for completion within the agreed timescale for closure; and
 - Implementing an appropriate escalation process when any NCR or CAR exceeds the agreed closure date.

22.10 Inspection and Testing

- 22.10.1 The *Contractor*, his designers, Subcontractors and suppliers engaged in the design, supply manufacture, construction, installation, commissioning and testing or any other service connected with the *works*, shall maintain ITP's to satisfy the requirements of BS EN ISO 9001, and TfL Standard S1538 Assurance, and other relevant Statutory Requirements appropriate for the deliverables being provided. These ITP's are required to be submitted for review and acceptance by the *Project Manager*.
- 22.10.2 These accepted ITPs stipulate the necessary level and frequency of tests and inspections for each aspect of the *works* and also stipulate:
- Item(s) being inspected and tested;
 - The inspection and test activity;
 - Acceptance criteria
 - Involvement of various parties
- 22.10.3 Where the *Contractor* is responsible for the design, the *Contractor* shall stipulate the details to be completed in the ITPs including acceptance criteria. Activities listed in the ITP shall include pre-construction activities such as material approvals and completion activities such as the close out of any NCRs or snags. Where not specified, the *Contractor* shall propose acceptance criteria for the *Project Manager's* acceptance, including the method and frequency of inspection and testing.
- 22.10.4 The *Contractor* shall submit the ITP to the *Project Manager* four (4) weeks prior to the start of the relevant works unless agreed otherwise by the *Project Manager*. The *Contractor* shall not start the relevant works until the *Project Manager* has accepted the ITP. The *Contractor* shall maintain a schedule of ITP submissions with a record of the status of review and acceptance. Any further revisions, submissions and responses shall be made within the period for reply.
- 22.10.5 ITPs refer to those procedures, method statements and other documents such as national standards, codes of practice and legislation, which are to be used to control in-process and completed works. Records and other deliverables generated as part of the inspection and test process shall be identified within the ITPs. The ITPs shall also make clear who is responsible for implementing the planned arrangements, as well as who is responsible for certifying that compliance with requirements has been achieved in practice.

- 22.10.6 Mandatory interventions shall be defined as 'Hold Points', other interventions may include activities such as 'Witness Points' and 'Review Points'. The *Contractor* shall ensure a minimum of seven (7) days' notice is provided for Hold Points in the United Kingdom and fourteen (14) days' notice for those outside the United Kingdom.
- 22.10.7 The *Contractor* shall implement inspection checklists to verify conformance with the contract requirements. The *Contractor's* verification is accomplished by examinations, tests, measurement and inspection and by verifying records including those of his Subcontractors and suppliers. The *Contractor's* verification procedures shall be developed using applicable testing and inspection methods along with acceptance criteria stipulated by the drawings and materials and workmanship specifications.
- 22.10.8 The *Contractor* shall ensure that staff nominated for undertaking sampling, inspection and testing activities are appropriately trained and competent to carry out the particular activities to which they have been assigned. The *Contractor* shall maintain records of training and competence and make such records available to the *Project Manager* for inspection upon request.
- 22.10.9 The *Contractor* shall conduct inspections and tests in accordance with his detailed quality plans and ITPs. Key inspection and test activities shall be agreed with the *Project Manager* in accordance with the relevant requirements in the Works Information. The *Contractor* shall record the completion of inspections and tests and identify records of the results.
- 22.10.10 The *Project Manager's* prior acceptance is required where an exception or deviation from specified requirements is proposed by the *Contractor*.
- 22.10.11 The *Contractor* shall produce a schedule of inspections to identify Defects and shall raise snagging lists or outstanding works lists at appropriate inspection and acceptance stages to record work that has not been completed correctly or which is outstanding. Defects identified during the inspection and included in these lists shall also require NCRs to be raised. Where testing and commissioning activities are to follow construction, access to defects list shall be provided to testing and commissioning personnel and their snagging/outstanding works items shall be included in these lists. Any items remaining open at Completion and any new Defects identified after Completion shall be transferred to a list of Defects for clearance.
- 22.10.12 Each NCR requiring a concession or design change shall be referred to the *Project Manager* by the *Contractor* for appropriate resolution. Any agreed remedial action shall be completed prior to the commencement of any further activities that may render the non-conforming item inaccessible, difficult to repair or increase the cost of the repair.
- 22.10.13 All testing where practicable shall be carried out by laboratories accredited by UKAS or similar, acceptable national body or by persons accredited to a similar standard. The samples shall be taken by staff appointed by the laboratory. The requirement for UKAS accreditation may be waived for the testing of systems and their components, subject to an alternative testing proposal by the *Contractor* and the acceptance of the proposal by the *Project Manager*.
- 22.10.14 Testing and sampling methodologies shall be in accordance with the standards and requirement of the contract, unless otherwise agreed by the *Project Manager*.

- 22.10.15 The *Contractor* shall maintain a schedule of all inspection, measuring and test Equipment used for the works that includes records of the calibration of such Equipment to nationally recognised standards.
- 22.10.16 All records from the inspection and testing process are referenced to the location of the item in the *works*, and collated and assembled as part of the Assurance documentation. Copies of all test plans, records and results will be kept in the Mandatory Asset Information Deliverables (MAID).

Appendix 22.1

Not Used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 23

Management and Administration of the Contract

Table of Contents

23.1	General	1
23.2	Glossary	1
23.3	Project Execution Plan	1
23.4	Roles & Responsibilities	3
23.5	Lessons Learned	4
23.6	Stakeholder Management	4
23.7	Key Performance Indicators (KPI)	5
23.8	Contractor's Organizational Chart	5
23.9	Contractor's Project Manager	5
23.10	Key Person Succession Plan	5
23.11	Contractor Performance Review Meetings	5
23.12	Contractor Project Progress Report	6
23.13	Office Facilities	7
23.14	Submission Acceptance Process	7
Appendix 23.1	Not Used	8

23.1 General

- 23.1.1 This Common Works Information 23 (CWI 23) describes the management and administration requirements that the *Contractor* shall comply with in Providing the Works.

23.2 Glossary

The terms and phrases defined in the below table apply to all elements of this CWI 23.

Term	Definition
BIM Execution Plan (BEP)	A plan, provided by the <i>Contractor</i> detailing how the <i>Contractor</i> will comply with requirements as set out in the Employers Information Requirements.
Contractor Performance Review Meetings	Periodic meetings with the <i>Project Manager</i> , <i>Contractor</i> , and Others, acting on their behalf to assess the project performance, progress, and health.
Employer's Information Requirements (EIR)	Sets out the standards to be used and required details relating to the data and information about the <i>Employer's</i> engineered asset's physical and functional characteristics, how these shall be captured, produced, generated, utilised and managed by its suppliers. An EIR template can be found in Appendix 11.1.
Key Person Succession Plan (KPSP)	The Key Person Succession Plan gives the <i>Project Manager</i> confidence that replacement Key Personnel will be properly appointed and inducted and the workload will be handed over to them in a structured and orderly fashion.
Procurement Plan	The Procurement Plan demonstrates how the <i>Contractor</i> will comply with the procurement related requirements of the Works Information, and in particular the Responsible Procurement requirements.
Project Execution Plan	The Project Execution Plan is to demonstrate to the <i>Project Manager</i> how the <i>Contractor</i> will organise and manage the delivery of the <i>works</i> through all its relevant phases.
Project Kick-off Meeting	An initial meeting between the <i>Contractor</i> and the <i>Project Manager</i> to agree principles of working together going forward.
Project Progress Report	A periodic report, produced by the <i>Contractor</i> , to highlight works that have been performed in that period and to assess the ongoing project health using key project metrics.

23.3 Project Execution Plan

- 23.3.1 Within twenty (20) Working Days of the *starting date*, the *Contractor* shall produce and submit to the *Project Manager*, for review and acceptance, a Project Execution Plan.
- 23.3.2 The purpose of the Project Execution Plan is to demonstrate how the *Contractor* will organise and manage the delivery of the *works* through all its relevant phases.

23.3.3 The Project Execution Plan shall:

- (a) outline the overall vision for delivery of the *works*;
- (b) document all the *Contractor's* plans for Providing the Works and show how they fit within the structure of the Contract, their respective purpose and high-level context including:
 - (i) detailing how the *Contractor* will manage its performance of the *works*;
 - (ii) setting out the management structure who will be accountable and responsible for delivering all facets of the *works* including Key People, their role and function in delivering the *works*, reporting lines and organisation structure; and
 - (iii) identifying within the management structure, the key role interfaces, such as with, inter alia, the *Project Manager*, Network Rail (where relevant), competent authorities, and Others, by the *Project Manager* and/or the *Employer*.
- (c) provide a summary statement of how the *Contractor* plans to Provide the Works to achieve Key Dates and Completion, cost effectively;
- (d) describe when the *Contractor* will provide the plans, procedures and other deliverables set out in the Works Information;
- (e) act as an index to other plans, should the reader wish to read further and provide a document tree with a clear hierarchy.

23.3.4 The *Contractor* shall use the Project Execution Plan structure shown below, with the following minimum content. Should the *Contractor* request a change or omission to this PEP structure, the *Contractor* shall submit their proposed outline format of the Project Execution Plan to the *Project Manager* for initial review within five (5) Working Days of the *starting date*.

Section	Outline Contents
Vision	An outline of the overall vision for the delivery of the <i>works</i> including the objectives of the Implementation Works Terms and which shall align with the programme management plan.
Scope	Summary of the scope of the contract including the Prices, Key Dates, Completion date, access planning and management, design management, coordination between system and station designs, subcontracting, training, handover, regular maintenance and reactive maintenance.
Organisation	Core roles and resourcing including Key People and key role interfaces. <i>Contractor's</i> organisation chart, and indicative team structure for each key project stage Key Person succession

Section	Outline Contents
Project Controls	<p>Summary of how controls will be implemented for the <i>works</i>, including the approach to:</p> <ul style="list-style-type: none"> • estimating • risk management • reporting progress and performance • planning and scheduling • document management • cost management • commercial management • stakeholder and communications management
Delivery Approach	<p>Description of the approach being used to Provide the Works</p> <ul style="list-style-type: none"> • Summary of the Procurement Plan for the <i>works</i> • Summary of how the <i>Contractor's</i> responsible procurement and sustainable delivery obligations will be met • Summary of the contract management approach • Summary of construction and logistics strategy for Works across multiple site locations
Collaboration	<p>How the <i>Contractor</i> will embrace collaborative working, Schedule 3 of the General Terms.</p>

23.3.5 The *Contractor* shall review and if necessary revise the Project Execution Plan annually, on the anniversary of the *starting date* and submit the revised Project Execution Plan to the *Project Manager* for review and acceptance.

23.4 Roles & Responsibilities

23.4.1 As part of the *Contractor's* mobilisation duties, the *Contractor* shall ensure it understands the structure and format of the *Project Manager's* project team.

23.4.2 The date and location of the Project Kick-off Meeting will be confirmed by the *Project Manager* on the *starting date*. The Project Kick-off Meeting may be attended by the *Employer's* Senior Representative (Project Director), or a delegate on their behalf. The agenda for the Project Kick-off Meeting will include (but not be limited to):

- (a) introduction of key project team members from both the *Employer* and *Contractor*;
- (b) presentation from the *Contractor* on how the project will be achieved successfully;

- (c) discussion on Project Execution Plan document in its current state;
 - (d) discussion regarding the Employer's Information Requirements (EIR) and agree the content of the BIM Execution Plan (BEP);
 - (e) agreement between *Employer* and *Contractor* on how communication will be managed as the project commences; and
 - (f) agreement of sharing useful documents, resources, and knowledge from both *Employer* and *Contractor* to aid the successful kick off of the project.
- 23.4.3 All Communication from the *Contractor* shall be directed to the *Project Manager* via the CAMS. The *Project Manager* and the *Contractor* shall jointly agree the working day-to-day lines of communication between the respective project personnel and the extent of any circulation.
- 23.4.4 The *Contractor* shall ensure that its project team and organisation (wherever located) are established and adapted as necessary to facilitate effective communications between the *Contractor* and the *Project Manager*.
- 23.4.5 The *Contractor* shall ensure appropriate systems, procedures and processes are in place for the ongoing management of project controls, governance, reporting, and auditing.
- 23.4.6 The *Project Manager* shall have the right to access and review the *Contractor's* project controls activities and shall have the right to conduct any assurance, verifications and or audits.

23.5 Lessons Learned

- 23.5.1 Within twelve (12) weeks of the *starting date* the *Contractor* shall participate in a joint workshop addressing lessons learned with the *Project Manager*. This is to be organised and chaired by the *Project Manager*.
- 23.5.2 The general scope of this joint workshop shall include a review of historic lessons learned from other projects of similar scope and complexity.
- 23.5.3 The *Project Manager* shall collate and enter outputs from the joint workshop addressing lessons learned on a lessons learned table.
- 23.5.4 The *Contractor* shall use the outputs of the joint lessons learned workshop to review and update each relevant plan and or procedure relating to the Providing the Works when the *Contractor* next re-submits the updated plan(s) or procedure(s) for review and or acceptance.

23.6 Stakeholder Management

- 23.6.1 The *Project Manager* is responsible for the production and implementation of a DTUP stakeholder and communications management plan (SCMP). The *Contractor* shall provide input and support as necessary in the development and delivery of the SCMP, supporting stakeholder documentation, or in the provision of specialist advice to support the project's successful relationship with internal and external stakeholders for the duration of the *works*.

23.6.2 The *Contractor* shall submit its own SCMP, to the *Project Manager* for acceptance, within twenty (20) Working Days of the *starting date*. The *Contractor's* SCMP that will set out arrangements for how they will manage, control and communicate with the *Contractor's* stakeholders relating to their delivery activities and those of their supply chain. The *Contractor's* SCMP shall be reviewed and updated for acceptance every fifty two (52) weeks, from acceptance of the initial submission.

23.7 Key Performance Indicators (KPI)

23.7.1 Not used.

23.8 Contractor's Organisation Chart

23.8.1 Within twenty (20) Working Days of the *starting date* (and thereafter updated every twenty six (26) weeks), the *Contractor* shall issue, for acceptance, to the *Project Manager*, an entire organisation chart of all resources (including Subcontractors) Providing the Works. The organisation chart as a minimum shall identify the individual by name, position held and level of engagement in Providing the Works (full-time or part-time). The organisation chart shall also be arranged to clearly detail the reporting lines.

23.9 Contractor's Project Manager

23.9.1 The *Contractor's* Project Manager shall have full authority to act on behalf of the *Contractor* for the purposes of Providing the Works. The *Project Manager* shall in all such matters look to the *Contractor's* Project Manager as if such person were the *Contractor*.

23.10 Key Person Succession Plan

23.10.1 The *Contractor* shall within forty (40) Working Days of the *starting date*, submit to the *Project Manager* for acceptance a Key Person Succession Plan (KPSP). The KPSP will be updated for acceptance every fifty-two (52) weeks from the *starting date*. The purpose of the KPSP is to give the *Project Manager* confidence that replacement Key Personnel will be properly appointed and inducted and the workload will be handed over to them in a structured and orderly fashion.

23.10.2 The KPSP shall include as a minimum the following:

- (a) details of any planned replacement Key Personnel during the contract;
- (b) processes as to how a suitable replacement is appointed;
- (c) processes for handing over duties including length of shadowing time;
- (d) submission of CV(s) / resume(s) to the *Project Manager*, and
- (e) details of how the *Contractor* proposes to mitigate disruptions of replacements such that there is no impact on the *Contractor* Providing the Works.

23.11 Contractor Performance Review Meetings

23.11.1 The *Contractor* shall attend Performance Review Meetings, held by the *Project Manager*, every four (4) calendar weeks, with the first meeting to be held within eight (8) calendar weeks of the *starting date*.

23.11.2 The meetings as a minimum shall review the following topics:

- (a) Health, Safety and Environment;
- (b) Progress – planned vs actual, proposed mitigation (if applicable), etc.;
- (c) Programme – four (4) and twelve (12) week look ahead;
- (d) Cost – planned vs actual in the period and twelve (12) week look ahead forecast;
- (e) Overview of commercial performance, including status of Bill of Quantities;
- (f) Risks;
- (g) Performance;
- (h) Quality;
- (i) Design – planned vs actual;
- (j) Subcontracting;
- (k) Responsible Procurement and Sustainable Delivery;
- (l) Strategic Workforce – Trainees and Apprentices;
- (m) Third party liaison, consents and heritage;
- (n) Lessons learned; and
- (o) Any other business subjects, as the need arises.

23.11.3 The *Contractor* shall ensure that there is a requirement for their Subcontractors to attend these meetings as and when required by the *Project Manager*.

23.11.4 The *Project Manager* shall document the minutes of the meeting and distribute to attendees, within five (5) Working Days of the meeting.

23.12 Contractor Project Progress Report

23.12.1 The *Contractor* shall submit, to the *Project Manager*, a Contractor Project Progress Report at least two (2) Working Days prior to each Contractor Performance Review Meeting. The Contractor Project Progress Report will be a detailed assessment of the project performance for each reporting period. It will act as the detailed content of the Contractor Performance Review Meetings, for both parties to monitor and manage the project.

23.12.2 The *Contractor* will include in the report, a one-page dashboard summary of key project highlights. The format of this is to be agreed by both parties, on a periodic basis, as a method of assessing key metrics of project health.

23.12.3 The *Contractor* shall include in the Contractor Project Progress Report, a fully detailed resource report including the graphical demonstration of 'planned headcount' v 'actual headcount' and 'planned cost v actual cost' on a periodic, cumulative and forecast final reporting basis and in such detail together with all supporting documentation as to enable the *Project Manager* to fully review.

23.13 Office Facilities

23.13.1 The *Contractor* shall provide the following at its designer's project office for the *Project Managers* use:

- (a) five (5) desks (including chairs and access to power (two sockets per desk));
- (b) access to and use of a guest Wi-Fi internet connection;
- (c) access to and use of a meeting room which can accommodate ten (10) people, the meeting room should have:
 - (i) teleconferencing and internet conferencing facilities;
 - (ii) a whiteboard; and
 - (iii) presentation facilities (screen or projector)
- (d) Use of any existing communal kitchen and welfare facilities.

The *Contractor* shall ensure that the above is available for the *Project Managers* use from the commencement of the design until completion of the LUL Network Integration Testing.

23.13.2 The *Contractor* shall make available, three (3) desks in their contract execution offices. These desks will be available as 'hot desks' for visiting project personnel to use for the duration of the Contract.

23.14 Submission Acceptance Process

23.14.1 Unless expressly stated otherwise in the Works Information, all non-engineering *Contractor* submissions to the *Project Manager* for acceptance shall adhere to the following:

23.14.2 The *Project Manager* shall either accept a submission or reject it. An explanation for the rejection of the submission and any action(s) / issues that are required to be addressed in the resubmission will be identified and provided to the *Contractor*. The *Project Manager* will review and assign / code each submission with one (1) of the following:

- A - Accepted - work may proceed as proposed;
- B - Accepted subject to comment(s) - in which case work may proceed subject to incorporation of the changes/actions indicated and the document revised and resubmitted to the *Project Manager* for acceptance;
- C - Rejected - in which the submission must be resubmitted to the *Project Manager* for review and acceptance. Work may not proceed; or
- D - Information only - where the *Project Manager* does not intend to review but acknowledges receipt, in which case work may proceed as proposed.

23.14.3 All Engineering deliverables / submissions to the *Project Manager* for acceptance are governed by CWI 06.

Appendix 23.1

Not Used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 24

Project Controls and Reporting

Table of Contents

24.1	General	1
24.2	Glossary	1
24.3	TfL Project Management Framework and Stage Gates	1
24.4	Project Controls Audits	1
24.5	Work Breakdown Structure, Cost Breakdown Structure and List of Control Accounts	1
24.6	Cost Management	2
24.7	Contractor Weekly Viz Board Report	8
24.8	Risk Management	9
Appendix 24.1 DTUP Work Breakdown Structure for the OPO CCTV System Contract		10

24.1 General

The *Contractor* and the *Project Manager* shall jointly agree after contract award, the date and time for the project controls and reporting kick off meeting. The purpose of this meeting is to formalise the *Contractor* with the project controls requirements and delivery protocols.

24.2 Glossary

Term	Definition
Contractor Weekly Viz Board	A weekly progress report provided to the <i>Project Manager</i> by the <i>Contractor</i> .
DTUP Risk Management Process	<i>Contractor</i> and <i>Employer</i> programme professionals and senior management attend quarterly risk identification workshops, as well as four (4) weekly risk mitigation meetings.
TfL Project Management Framework and Stage Gates	TfL's assurance process.

24.3 TfL Project Management Framework and Stage Gates

24.3.1 The *Contractor* shall support the *Project Manager* in complying with the TfL Project Management Framework and Stage Gates. The *Contractor* makes available its personnel (including Subcontractor and/or supplier personnel (as required)) to attend and participate in workshops and meetings as required by the *Project Manager*.

24.4 Project Controls Audits

24.4.1 The *Project Manager* and/or the *Employers Audits Agents* shall perform project controls audits. The *Contractor* will support these audits and shall provide all information and substantiation requested, this shall include but is not limited to, the attendance of relevant *Contractor* personnel to discuss such matters at audit meetings.

24.4.2 The *Contractor* shall notify the *Project Manager* no later than ten (10) Working Days prior to any planned *Contractor* performed project controls audit(s). The *Contractor* shall provide the *Project Manager* and/or the *Employer* the opportunity to jointly participate in and/or observe the *Contractors* project controls audit(s). The *Contractor* shall submit to the *Project Manager* for information a complete (unamended and/or unredacted) copy of its audit findings report within ten (10) Working Days of each audit being performed.

24.5 Work Breakdown Structure, Cost Breakdown Structure and List of Control Accounts

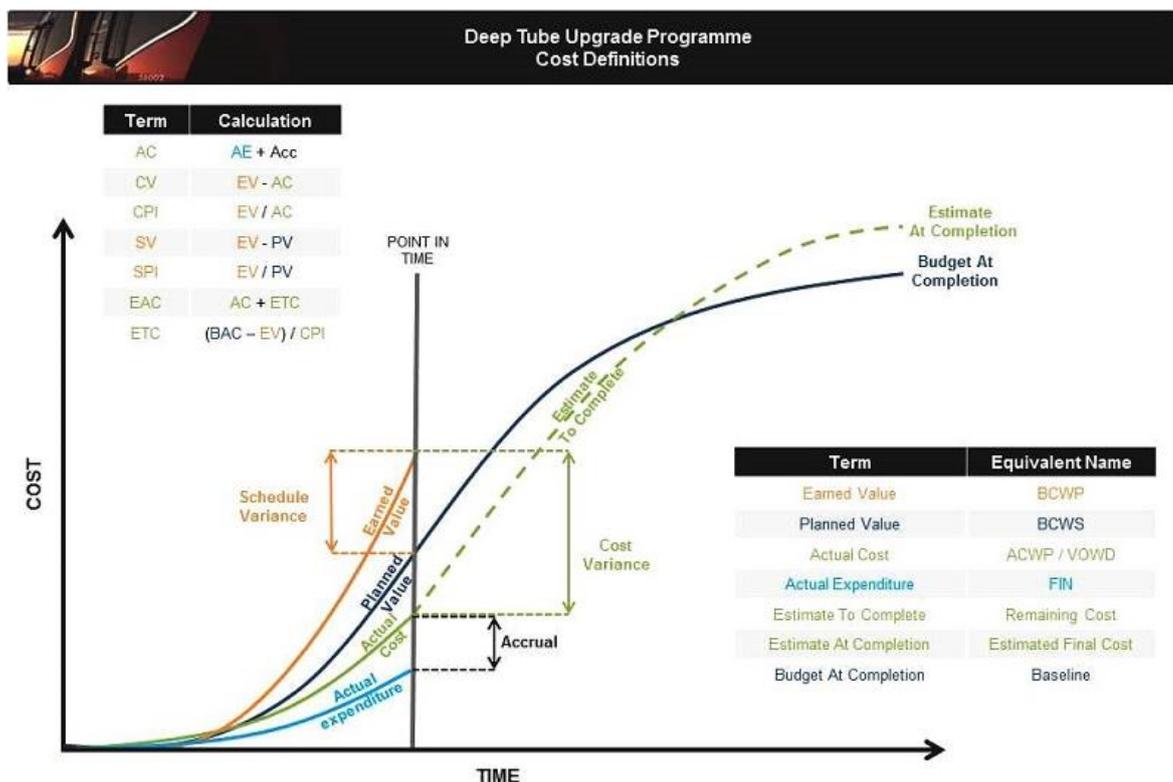
24.5.1 The *Contractor* shall, within twenty (20) Working Days of the Contract Commencement Date, develop and submit to the *Project Manager* for acceptance, a deliverable-based work breakdown structure ("Work Breakdown Structure" or "WBS") and cost breakdown structure ("Cost Breakdown Structure" or "CBS") which subdivides the scope into

manageable elements of work so that schedule and cost data can be linked, captured, recorded and measured on a consistent basis.

- 24.5.2 The *Contractor's* WBS and CBS shall align and cross-reference with the Deep Tube Upgrade Programme (DTUP) Work Breakdown Structure (WBS) detailed in Appendix 24.1. Further details on the coding structure will be discussed in the project controls and reporting kick off meeting with the *Project Manager*.

24.6 Cost Management

- 24.6.1 The *Contractor* shall maintain a fully auditable cost control system which enables full compliance with the *Employers* requirements and reporting procedures. It shall enable the monitoring and forecasting of Budgeted Cost of Work Schedule (BCWS) (also known as the Planned Value), the Value Of Work Done (VOWD) (also known as the Actual Cost of Work Performed (ACWP)), the Estimate To Complete (ETC) (also known as the Remaining Cost) and the Estimated Final Cost (EFC) (also known as Estimate At Completion) on a periodic basis. The *Employer* uses a thirteen (13) period fiscal calendar that runs from April to March (Refer to the Contract Data). The *Contractor* shall use this calendar when reporting costs and other data, and will comply to the *Project Manager's* reporting. Please refer to the below diagram that summarises these terms.



24.6.2 Cost Estimating

All cost estimating data shall be presented in a working Excel format (or an equivalent format agreed by the *Project Manager*) and shall align to the DTUP WBS and CBS.

24.6.3 Budget Control

- (a) The agreed cost estimate at the contract date shall represent the original budget (also known as the Target Cost or baseline). The original budget shall be revised for implemented compensation events and shall be known as the current budget.
- (b) A formal change management system that has been agreed by the *Project Manager* shall be developed jointly to keep the information current. The change management system shall cover all aspects of change including: scope, quantity, time, cost and risk. The change management system developed shall (in addition to other contractual requirements and obligations), identify variances so that there may be sufficient time to:
 - mitigate any adverse effects; or
 - carry-out any actions required to achieve an identified saving or benefit.
- (c) The current budget provides a baseline with which to compare the *Contractor's* actual progress and performance, identify deviations from the baseline for analysis and if necessary, decide actions to possibly recover and/or mitigate within a timeframe agreed by the *Project Manager*. The *Contractor* and the *Project Manager* shall agree how the cost information provided at tender return is restructured to allow monitoring of the forecast of Defined Cost (also known as EFC or Estimate At Completion) against the current budget. This restructuring shall take into account the requirements of the WBS, CBS, and the List of Control Accounts and shall support the requirements of earned value reporting.
- (d) The breakdown of the current budget (and subsequent changes) shall be submitted by the *Contractor* for review and acceptance by the *Project Manager* at agreed periodic intervals.
- (e) All cost estimating data and supporting substantiation shall be presented in a working Excel format (or an equivalent format agreed by the *Project Manager*).

24.6.4 Cost Forecast

- (a) The *Contractor* shall submit the cost forecast to the *Project Manager*, no later than twenty (20) Working Days after the Contract Commencement Date. An updated cost forecast is submitted to the *Project Manager* no later than the Friday of week two (2) of each period thereafter until Completion of the whole of the *works*. The cost forecast shall total the agreed Estimated Final Cost forecast in a format proposed by the *Contractor* and accepted by the *Project Manager*.
- (b) Each four (4) weekly period, the *Contractor* shall update reports and graphs to show the status of actual cost to date and forecast cost to go, by period, against the baseline budgeted cost. The updates shall be included in the periodic *Contractor Performance Review Report (CPRR)*.

24.6.5 CPRR

- (a) The *Contractor* shall issue a comprehensive progress report at four (4) weekly intervals to align with the *Employers* thirteen (13) period fiscal calendar and reporting cycle. The *Project Manager* shall advise the timing of this report. The first progress report is issued at a date to be directed by the *Project Manager* which shall be no later than twenty (20) Working Days after the Contract Commencement Date.
- (b) The *Contractor* shall submit one (1) electronic copy of each progress report to the *Project Manager*.
- (c) The format and contents of the report is to be jointly agreed with the *Project Manager* prior to the submission of the first report. The submission shall include both quantitative metrics with qualitative narrative to explain them.

Further details of particular sections of the CPRR are set out below:

(N.B. The following is not exhaustive and represents only the minimum required)

- Executive Summary and Key Issues

This section should be no more than two pages summarising the achievements and key issues and interfaces experienced during the period, the safety report, and the commercial position.

Achievement of agreed key performance indicators shall be reported here including earned value metrics.

- Health, Safety and Environment

This section contains a summary of all activities related to health, safety and environment such as meetings, safety reviews, audits, safety beacons awarded/failed, instructions, inductions, incidents, waste disposal, aspects of systems safety and special achievements.

Safety statistics, incident frequency rates (IFR) including all lost time incidents (LTI) and RIDDOR in the period and cumulative shall be included as well as incident close out times.

Numbers of site visits and safety inspections undertaken in the period.

Trends are provided together with proposed action to improve safety performance.

Toolbox talks - The contractor shall detail any short presentations that have been rolled out to the workforce on a single aspect of health and safety in the period.

Initiatives - The contractor shall detail any specific assignments undertaken in the period or provide updates to any ongoing assignments that are being undertaken to achieve specific objectives in the near-term, such as to reduce costs, increase efficiency, and improve quality or safety.

Lessons Learnt - The contractor shall detail any specific lessons learnt in the period and/or any other activities that have taken place in order to learn from lessons such as workshops, etc.

- Progress

This section comprises of a narrative report, and where applicable graphics, data and photos, on the progress achieved against that planned in the period, together with explanations of any delays incurred, the reason for any delays, the impacts to the Programme and details of plans on how the delays are to be recovered or minimised. The *Contractor* should also detail the proposed and actual measures taken to ensure similar delays are not incurred in the future.

Progress is reported against the latest accepted programme on a physical percentage complete basis by discipline and overall and on schedule performance indicators (SPIs).

The report describes the work which is on the critical path(s), noting the amount of remaining work.

- Programme Narrative

This section identifies the current accepted programme and summarises the information contained on each programme which the *Contractor* submits for acceptance. The *Contractor* comments on the progress of all aspects of the *works* including design, procurement and construction.

Special emphasis is given to issues notified, or to be notified, as early warnings which may delay Completion of the whole of *works* or delay achievement of a Key Date.

- Resources (Manpower and Equipment)

This section shows in tabular and graphical form the planned and actual man-hours (by discipline), including Subcontractor manpower deployed for each activity during the period cumulatively. A narrative describes any items where a shortfall of manpower is affecting progress and what mitigating actions are being undertaken. (Estimates and/or full time equivalent man-hours are not acceptable alternatives for reporting actual man-hours)

Project Manager agreed productivity factors by work crews, by discipline and by shift, is analysed and reported with reasons for underperformance including measures being taken to achieve the plan and recover performance.

The *Contractor* reports workforce turnover in the period cumulatively, and the measures being taken to recover and maintain the planned workforce level.

This section also schedules the actual Equipment used, and its performance versus that planned, in the period. Equipment breakdowns impacting on progress during the period shall be reported. Measures being taken to recover lost production shall also be identified.

This section should also be used to provide information on any large manpower or equipment initiatives such as academies or apprenticeships, and include statistics and initiative on the diversity and inclusion of the nine protected characteristics of the equality act,

- Design

This section describes the status of the design and engineering of the *works*. The percentage status of completion of each drawing proposed, the percentage of drawings completed, the percentage of drawings reviewed by the *Project Manager* and the number and category of drawings to be completed shall be recorded. The *Contractor* identifies the progress on preparation of the assurance package(s). The status of technical queries are reported and critical issues are highlighted for the *Project Managers* attention.

The *Contractor*, from the design sub-network in the accepted programme described below, reports the status of design relative to the critical path. The *Contractor* shall also analysis the planned level of design completion (by drawing and/or package of drawings) against the actual design progress achieved and detail what measures will be taken by the *Contractor* to mitigate any slippage.

- Procurement

This section describes the status of procurement (including procurement and management of Subcontractors) and purchasing, including delivery of all Equipment, Plant and Materials. It shall highlight those items that have long lead times or where the procurement dates have limited float. It should also provide detail on ethical or ecological sourcing.

- Cost and Commercial

- (i) Compensation Events

The *Contractor* provides a summary and the current status of all Compensation Events issued in the period of report, and to date.

- (ii) Early Warning Notices

The *Contractor* provides a summary of all early warning matters raised in accordance with clause 16 of the conditions of contract giving the date raised, date of any risk reduction meeting held and a reference to records made by the *Project Manager*.

(iii) Forecast of Defined Cost

The *Contractor* provides a forecast that includes a summary of all expenditure to date, assessment of earned value to date, and shall identify all risk allowances, compensation events and early warnings which the *Contractor* has allowed for in the forecast. The forecast is updated at intervals no longer than set out in the Contract Data.

(iv) Earned Value Analysis

Earned value analysis techniques is utilised by the *Contractor*. Earned value versus planned earned value and Defined Cost shall be represented in both tabular and graphic formats. Progress measurement methods shall be submitted to the *Project Manager* for acceptance. Earned value reports are included with each four (4) weekly progress report.

(v) Cost and Schedule Performance

The report highlights any cost and/or schedule variances between budgeted / forecasted and actual, both in the period and cumulatively and describes the impact of the variances on the final cost and schedule.

Cost performance indicators and schedule performance indicators are developed from the earned value analysis to trend the overall performance of the contract. The numerical analysis are supported by narrative explaining the reasons for any variances and giving the *Contractor's* proposed mitigation plans and actions to correct or minimise any overruns.

(vi) Cash flow forecasts

The *Contractor* submits a cash flow forecast broken down to correspond with each activity incorporating all the latest time and cost adjustments. All forecasts are to be submitted in electronic copy format.

(vii) Risk and Opportunity Management

The reporting of risks and opportunities shall be carried out by the Employers risk management team and as a consequence there shall not be a requirement for the *Contractor* to report risk separately.

(viii) Quality and Assurance

This section details:

- Progress on safe system of works, procedures, inspection and test plans;
- Any concerns or difficulties in providing certification or quality records to demonstrate the compliance of completed work;

- A summary of the assessment and monitoring of suppliers and Subcontractor's quality systems that has been carried out;
- Summary of recent ongoing and planned quality audits;
- Status of all non-conformance reports (NCRs);
- Status of all corrective action requests (CARs); and
- Any other significant quality issues.

(ix) Stakeholders Activities

This section shall describe any matters relating to community relations, stakeholder management, consents, any engagement, and any related issues and incidents.

(x) Progress photographs

The *Contractor* provides progress photographs with each period report. The photographs shall be still, dated, colour and of a digital format.

A representative selection of the photographs shall be included in the *Contractor's* four-weekly progress report.

The *Project Manager* may request that particular locations and details be recorded at any time as a record of progress.

The photographs are held in the *Contractor's* central electronic records and shall be accessible to the *Project Manager*.

Photographs shall be of suitable quality for reproduction at A3 size.

24.7 Contractor Weekly Viz Board Report

24.7.1 The *Contractor* shall issue a weekly report that details the following:

- Any issues the *Contractor* is suffering including mitigation actions with forecast completion dates;
- Planned headline achievements from last week (achieved or not);
- Planned headline achievements to be completed in the next ahead;
- Injuries and near misses reported in the week;
- Asset damage reported in the week;
- Cumulative near misses and asset damages recorded;
- Average incident close out rate compared to the target day close out for TfL;
- Over-runs or other significant loss of service in the week; and
- High risk works and planned closures to be completed in the next ahead.

- 24.7.2 The *Contractor* shall, within twenty (20) Working Days of the Contract Commencement Date, issue to the *Project Manager* for review, the first *Contractor Weekly Viz Board Report* and then weekly updates thereafter.
- 24.7.3 The *Contractor* shall submit one (1) electronic copy of each *Contractor Weekly Viz Board Report* to the *Project Manager*.

24.8 Risk Management

- 24.8.1 The *Contractor* will actively participate in the DTUP Risk Management Process. Typically this will involve ensuring skilled programme professionals and senior management from the *Contractor's* team are available to attend quarterly risk identification workshops alongside the Employers team, as well as four (4) weekly risk mitigation meetings to reduce risks, and ensure delivery of mitigation actions to prevent risk occurrence.
- 24.8.2 The *Project Manager* will advise the *Contractor* of the dates (and location(s)) that the *Contractor* will be required to attend these meetings. The *Contractor's* Subcontractors may also be asked to participate within these sessions, as appropriate. Furthermore, the Subcontractors will be available to advise on specialist risk areas that may be encountered, and on the assessment of the level of risk exposure faced. In all cases, the *Project Manager* will take the lead on integrating these measures, with the *Contractor* being expected to participate and share their specialist knowledge/ experience.

Appendix 24.1 – DTUP Work Breakdown Structure for the OPO CCTV System Contract

SAP Level 5	SAP Level 6	SAP Level 7	Code Value	Code Description
DTUP	Piccadilly	Train Systems	P.UIP3231	OPO CCTV
DTUP	Piccadilly	Train Systems	P.UIP3231.001	Contracts
DTUP	Piccadilly	Train Systems	P.UIP3231.001.001	OTC
DTUP	Piccadilly	Train Systems	P.UIP3231.001.002	OPO CCTV Design
DTUP	Piccadilly	Train Systems	P.UIP3231.001.003	OPO CCTV Implementation
DTUP	Piccadilly	Train Systems	P.UIP3231.001.004	Stopping Positions
DTUP	Bakerloo	Train Systems	B.UIP3231	OPO CCTV
DTUP	Bakerloo	Train Systems	B.UIP3231.001	Contracts
DTUP	Bakerloo	Train Systems	B.UIP3231.001.001	OTC
DTUP	Bakerloo	Train Systems	B.UIP3231.001.002	OPO CCTV Design
DTUP	Bakerloo	Train Systems	B.UIP3231.001.003	OPO CCTV Implementation
DTUP	Bakerloo	Train Systems	B.UIP3231.001.004	Stopping Positions

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 25

Programme

Table of Contents

25.1	General	1
25.2	Glossary	1
25.3	Programme Activities	2
25.4	Programme Requirements	2
25.5	Programme Narratives	8
25.6	Cost, Resource and Manpower Histograms	9
25.7	Weekly Work Plans	9
25.8	Daily Log	9
Appendix 25.1	Mandatory Activity Codes	11

25.1 General

This Common Works Information 25 (CWI 25) further defines the *Employer's* requirements with regard to the programme. This section will:

- describes the *Employer's* minimum generic requirements for the programme management of the *works* by the *Contractor*;
- defines programme management and performance tasks that are required to be carried out by the *Contractor* in order to efficiently deliver the *works*; and
- describes the documents that the *Contractor* shall submit to the *Project Manager* for acceptance and those that the *Contractor* shall submit to the *Project Manager* which are subject to review and or audit in accordance with the Implementation Works Terms.

25.2 Glossary

The following terms are applicable to this CWI 25:

Term	Definition
Level 1 Project Milestone Schedule	An overall management level summary schedule for Providing the Works
Level 2 Project Summary Schedule.	A bar chart format providing a high level view of the sequence of operations and main activities of the works.
Level 3 Control Account and Work Package	Details of control accounts and work packages developed by the <i>Contractor</i> using the critical path method / network analysis techniques to produce a coherent programme that covers the entirety of the <i>works</i> .
Level 4 Rules of Credit Schedules	Programmes are vertically integrated and include the most detailed level at which the works are planned, measured and reported.
Weekly Work Plan	A four (4) week rolling programme (one week look back and three weeks look ahead) covering day to day activities.

25.3 Programme Activities

- 25.3.1 The *Contractor* shall identify an appropriate number of activities to reflect the delivery of the *works*. Activities shall typically not be longer than two reporting intervals. Activities shall describe works to be performed and not documents or processes. Activities shall be logically linked to form a critical path method network. Each activity shall be cross-referenced to the relevant Level 3 Control Account and Work Package in such a way that the programme can be organised by Work Package and Control Account. Major deliverables shall be identified and treated as discrete activities, Key Dates or milestones.
- 25.3.2 The *Contractor* shall develop and submit to the *Project Manager* for review and acceptance within twenty (20) Working Days of the Contract Commencement Date, the identification of suitable activities at Level 3 Control Accounts and Work Packages. The *Contractor* shall ensure that each activity belongs to one (1) Control Account and one (1) Work Package only.
- 25.3.3 The *Contractor* shall report programme progress and forecasting at the activity level within the CPRR.
- 25.3.4 The *Contractor* shall manage budgets, actual costs and forecast costs at the Work Package level, with progress data being derived from the activities.
- 25.3.5 The *Contractor's* time risk allowances for individual risk durations shall be included in the duration of the appropriate activity and details of the time risk allowance shall be shown in a user defined field separate to the duration. The *Contractor's* time risk allowances relating to a sequence of activities or operations shall be included in the appropriate section of the programme as one activity, with robust and concise logic, fully and clearly demonstrating the risk allocation of the associated sequence of operations.

25.4 Programme Requirements

- 25.4.1 General requirements for the programme include:
- (a) This section details:
- the requirements for preparation, updating and submission of the programme to be submitted to the *Project Manager* for review and acceptance;
 - The programme must achieve an Acumen Fuse (or equivalent, acceptable to the *Project Manager*) Index score of at least 75 per cent and the programme submitted by the *Contractor* shall include a copy of the Acumen Fuse (or equivalent) quality report for that programme.
 - the minimum required contents of the programme submitted for acceptance; and
 - the process and frequency of updates to the programme.
- (b) The programme shall comply with the dates in the Contract Data.
- (c) The programme shall be submitted to the *Project Manager* for acceptance in accordance with the timings identified in the Contract Data.

- (d) The *Contractor* shall clearly identify the start and finish dates and the critical path for the *works* within the programme.
- (e) The *Contractor* shall include within the programme all of the *Contractor's* obligations relating to Providing the Works and must include all milestones, Key Dates and the Completion of the *whole of the works*.
- (f) The *Contractor* shall ensure that the programme is produced using software tools and versions that are considered industry best practise and are acceptable to the *Project Manager*.
- (g) The *Contractor* shall, within the programme, identify, and make adequate provision for, the requirements stated in the Works Information.
- (h) The level of detail held in the programme must be sufficient to manage the performance of the *works*, but not so detailed that updating, forecasting and communicating could become problematic, unwieldy and would result in sub-optimal outputs disproportionate to the costs incurred in updating the programme.
- (i) All programme levels shall be vertically integrated, where the higher level of programmes will fully and accurately reflect the lower level detailed programmes. The *Contractor* shall develop the Level 1 Project Milestone Schedule, which will be supported by the Level 2 Project Summary Schedule.
- (j) The *Contractor* submits to the *Project Manager* for review and acceptance, a revised programme in '.xer' as well as PDF format on each Wednesday of each Week 4 of the LUL Accounting Period. The data date in the programme is set to the Sunday (beginning) of week 1 of that period in line with the data date.
- (k) The *Contractor* shall submit a Level 3 Control Accounts and Work Packages programme as part of the programme to be submitted to the *Project Manager* for review and acceptance, which shall be vertically integrated with the Level 2 Project Summary Schedule.
- (l) The *Contractor* shall develop the lower level of detail once the structure, content and level of details of the higher levels are agreed with the *Project Manager*. The programme shall be developed top-down based on agreed assumptions and dates, while being validated bottom-up based on performance and resource allocation.
- (m) The *Contractor* shall ensure that the programme is capable of running and reporting on earned value. Physical percentage complete must be based on units where possible, and activity rate of progress (percentage complete) must align with the activity forecast completion dates. Earned value will not be measured against level of effort costs such as project management and support as they can undermine the usefulness of earned value management, therefore the programme's structure shall ensure that such exclusions can be accommodated.
- (n) The *Contractor* shall capture actual Defined Cost for the purpose of earned value management and financial forecasting within the programme.
- (o) The *Contractor* shall reforecast planned work based on actual performance achieved and available resources after every LUL Accounting Period using the remaining duration of programme activities.
- (p) The *Contractor* shall identify adequate time risk provision against each relevant activity within the programme individually or as appropriate for a sequence of activities and/or operations.

- (q) The *Contractor* shall cross reference risks in the Risk Register against the programme.
- (r) The *Contractor* shall document planning assumptions and note subsequent changes for review at the project progress review meetings in order to ensure robust forecasting. The *Contractor* shall clearly identify programme assumptions likely to have an impact on project delivery into the Risk Register and then subject these assumptions to impact assessment through quantitative schedule risk assessment.
- (s) The *Contractor* shall identify any *Employer* dependencies and activities and submit these for acceptance to the *Project Manager*. Once accepted, the *Contractor* shall code such dependencies and activities using activity codes for review within the programme.
- (t) The *Contractor* shall include within the programme, as a minimum, start and finish dates and dependencies for each of the following, which shall reflect and be consistent with the requirements of these Implementation Works Terms:
- each review;
 - the delivery of Technical Information in accordance with the Design Management Plan;
 - design, development, prototypes, manufacture, delivery, testing and commissioning, reviews, IDC's and IDR's, hold points, free issue materials, training, etc;
 - handover, exchange and review of Interface Control Documents (ICDs) to the *Project Manager*;
 - the procurement of subcontracts for the supply of all critical subcontracts for the *works*;
 - the provision of operational spares and Special Tools and dates for delivery;
 - the information, approvals and other inputs that will be required by the *Contractor* from the *Project Manager*, Competent Authorities or other third parties (including Others);
 - all plans and consents that the *Contractor* is required to submit in accordance with these Implementation Works Terms;
 - all training requirements, manuals and equipment necessary completion of the *whole of the works*; and
 - Testing Inspection and Commissioning
- (u) On request by the *Project Manager*, the *Contractor* shall provide any additional details, dates or individual supporting programmes relating to a particular aspect of the programme to clarify their submission.
- (v) If the *Project Manager* accepts the programme, it shall replace any previous Accepted Programme from the date of the *Project Manager's* notice of acceptance.

25.4.2 Updates of the Programme

- (a) The *Contractor* shall include in each revised programme for acceptance a complete and transparent forecast of the timings and sequence of operations always and accurately reflecting current knowledge, assumptions and performance. The *Contractor* also include with each revised programme an updated programme narrative.
- (b) The *Contractor* shall also include in each revised programme the actual physical percentage complete for each activity.

25.4.3 Levels of Detail and Coding

- (a) The *Contractor* shall prepare each programme for acceptance such that the programme can be organised and summarised to the following levels of detail:
 - Level 1 Project Milestone Schedule;
 - Level 2 Project Summary Schedule;
 - Level 3 Control Accounts and Work Packages; and
 - Level 4 Rules of Credit Schedules.
- (b) Each activity shall be coded to identify which Control Account and Work Package it belongs to. Within twenty (20) working days of the Contract Commencement Date, the *Project Manager* shall provide the *Contractor* with Control Account codes. The *Contractor* shall also propose codes for Work Packages for the *Project Manager's* acceptance. Once accepted, no codes shall be changed without the *Project Manager's* prior written consent.
- (c) The *Contractor* shall construct its programmes such that activities are driven from or drive the Key Dates and the Completion of the *whole of the works* (including interface milestones), defined by the Contract Data. Interfaces with Others shall also be shown clearly on the programme and coded appropriately.
- (d) The *Contractor* shall use intelligent Activity ID coding such that Key Dates that are predecessors to the *Contractor's* activities are identified as Get milestones, and Key Dates which are successors to the *Contractor's* activities shall be identified as Give milestones.
- (e) The *Contractor* shall identify and code any activities which may have an impact on the operation of the LUL Network and Others.
- (f) The *Contractor* shall identify and code any scarce or specialist resources within the programme. The *Contractor* shall undertake time phased resource usage and forecast profiling and present these as part of each CPRR.
- (g) The *Contractor* shall identify and code within the programme any activities related to access to the LUL Network including all access requirements, closures and possessions (as applicable).

25.4.4 Level 1 Project Milestone Schedule

- (a) The “Level 1 Project Milestone Schedule” for the *works* shall be the overall management level summary schedule for Providing the Works. The content shall be consistent with the work breakdown structure (“WBS”) and include all Key Dates and Completion Dates stated in the Contract Data. Terminal float and planned completion shall be shown separately in the Level 1 Project Milestone Schedule.
- (b) The Level 1 Project Milestone Schedule shall be presented in a graphical format to provide a single page view of the provision of *works*. A baseline shall be used to demonstrate progress against the agreed dates.

25.4.5 Level 2 Project Summary Schedule

- (a) The “Level 2 Project Summary Schedule” for the *works* shall be the summarisation of the Level 3 Control Accounts and Work Packages schedule for the *works* and an expanded version of the Level 1 Project Milestone Schedule. The schedule shall be consistent with the WBS for the *works*.
- (b) The Level 2 Project Summary Schedule shall be presented in a bar chart format to provide a high level view of the sequence of operations and main activities of the *works*. An indication and a high level representation of the critical path shall be visible and a baseline shall be used to demonstrate progress.

25.4.6 Level 3 Control Accounts and Work Packages

- (a) The programme for the *works* shall be developed by the *Contractor* using the critical path method / network analysis techniques to produce a coherent schedule that covers the entirety of the *works*. The “Level 3 Control Accounts and Work Packages” shall be submitted to the *Project Manager* for review as part of the programme submitted for acceptance in its native electronic format (As agreed with the *Project Manager*).
- (b) The *Contractor* shall include as a minimum the following information in the Level 3 Control Accounts and Work Packages submitted to the *Project Manager* for review and acceptance:
 - the complete and full scope of the *works*;
 - the dates when the *Contractor* plans to submit any particulars of the design required by the *works*;
 - the dates when the *Contractor* plans to submit any particulars of the design of any items of Plant and Materials required by the *works*;
 - the dates when any of the design information or other information provided by the *Project Manager* or Others will be required by the *Contractor*;
 - details of any consents, permits and licences development, submission and approvals allowing sufficient time for each stage of the process and also allowances for resubmission;
 - details of any utility supplies development, submission and approvals, allowing sufficient time for each stage of the process and allowances for resubmission;

- details of any relevant third party (including Others) interfaces and submissions development, submission and approvals, allowing sufficient time for each stage of the process and also allowances for resubmission;
 - the dates when the *Contractor* plans to submit design and Completion certification as required by the *works*;
 - the dates and sequence of operations to support the implementation and delivery of the *works*;
 - the resource allocation required to support the implementation and delivery for the *works*;
 - the key quantities of materials required to support the implementation and delivery for the relevant *works*;
 - the calendar and working hours for each scheduled operation; and
 - all instructed and implemented Compensation Events issued by the *Project Manager*.
- (c) The *Contractor* shall link activities logically to identify interfaces and dependencies. Milestones shall be used to identify issue dates, review dates and key events. Time analysis shall be used to identify criticality. Resources shall be assigned to activities to establish manpower/key resource requirement and to identify the period of peak demand and bottlenecks.
- (d) All activities except Completion of the whole of the works shall have successors. All activities except the *starting date* shall have predecessors.

25.4.7 Level 4 Rules of Credit Schedules

- (a) All programmes shall be vertically integrated to the Level 4 Rules of Credit Schedules with associated data bases / data analysis containing rules of credit from which activity progress can be derived. This shall be the most detailed level at which the works are planned, measured and reported.
- (b) “Level 4 Rules of Credit Schedules” shall be submitted to the *Project Manager* for acceptance together with any and all supporting documentation and information.
- (c) The Level 4 Rules of Credit Schedules identify and track:
- progress against each deliverable item to be produced; and
 - productivity.
- (d) These deliverables shall be grouped to represent activities in the Level 3 Control Accounts and Work Packages schedule. The Level 4 Rules of Credit Schedules support the requirements of the Level 3 Control Accounts and Work Packages schedule.
- (e) Progress shall be measured using the appropriate established method of controls for each deliverable, including but not being limited to timesheets, material quantities, actual costs, milestones or activities achieved; in order to provide an overall percentage complete for the group of deliverables. This aggregated percentage complete shall be used to update the Level 3 Control Accounts and Work Packages schedule.

- (f) The Level 4 Rules of Credit Schedules shall be produced in any format the *Contractor* considers most appropriate including but not being limited to Microsoft Project, Microsoft Excel or Microsoft Access and Primavera, ensuring that the rules of vertical integration are being met. The format of the Level 4 Rules of Credit Schedules shall be submitted to the *Project Manager* for acceptance upon request.

25.5 Programme Narratives

25.5.1 The *Contractor* shall provide a programme narrative with each programme submitted to the *Project Manager* for review and acceptance. The narrative as a minimum (but is not limited to) shall include the following:

- executive summary;
- details of the *Contractor's* performance in the period and identification of any escalation matters that the *Employer* may be able to action;
- listing of key deliverables achieved in the period and the ones planned for the subsequent one;
- details of the programme basis and any assumptions and exclusions;
- details of the reasons for any artificial constraints or excessive lags;
- details of the productivity rates assumed in producing the programme;
- staffing plan indicating total manpower required per reporting period, inclusive of Subcontractors;
- description of the critical path;
- weather windows and other non-work periods (if applicable);
- listing of key interfaces with the *Project Manager* or Others and the dates those interfaces are planned to occur;
- listing of information which the *Contractor* requires the *Project Manager* to provide to enable it to comply with any programme date together with the date that information is required;
- comparison of the last Accepted Programme and the revised programme submitted for review and acceptance;
- details of any significant changes including revisions to critical path since the previous Accepted Programme;
- details of changes to Key Dates and associated float and time risk allowances;
- top ten (10) critical issues and the likely impact on the programme;
- list of the period implemented compensation events included and their impact; and
- any delay mitigation measures incorporated and any forecasted for the subsequent period;

25.6 Cost, Resource and Manpower Histograms

- 25.6.1 All programme submissions shall be fully cost and resource loaded. The resource loading of the programme shall facilitate the use of earned value techniques for assessment of progress, cost and performance.
- 25.6.2 The *Contractor* within ten (10) Working Days of the Contract Commencement Date shall submit to the *Project Manager* for acceptance its proposed method for resource loading the programme.

25.7 Weekly Work Plans

- 25.7.1 For each element of the *works*, the *Contractor* shall issue a “Weekly Work Plan”, no later than 09.00 hours on Friday of each week (or the next Working Day if Friday is not a Working Day). The Weekly Work Plan shall comprise a four (4) week rolling programme (one week look back and three weeks look ahead) covering day to day activities.
- 25.7.2 Weekly Work Plans are to be submitted in electronic format to the *Project Manager*.
- 25.7.3 The headings in the Weekly Work Plans shall include ‘Safety’, ‘Progress’, ‘Programme’, ‘Design’, ‘Quality’, ‘Access’, ‘Environment’ and ‘Issues’.
- 25.7.4 The Weekly Work Plan shall indicate the timing of all proposed hold points in the inspection and test plans identified by the *Project Manager*, for inspection by the *Project Manager* or by Others who have the right of inspection.
- 25.7.5 The Weekly Work Plan shall include a narrative report on each element of the *works* describing the progress over the week look back and planned for the three weeks look ahead.
- 25.7.6 The *Contractor* shall submit the format of the Weekly Work Plan to the *Project Manager* for acceptance within ten (10) working days of the Contract Commencement Date. The first submission of the Weekly Work Plan is to be agreed with the *Project Manager*.
- 25.7.7 The Weekly Work Plan shall be discussed at a work plan meeting to be held by the *Contractor* at the time of issue of the Weekly Work Plan. The *Contractor* shall notify the *Project Manager* of such meeting so that the *Project Manager* may attend the work plan meeting. The *Contractor* shall require section managers to be accountable for the delivery of the *works* and to present their section and account for the performance and the short-term plan
- 25.7.8 Each activity in the Weekly Work Plan shall be related to one (1), and only one (1), activity in the *Contractor's* Level 3 Control Accounts and Work Packages schedule.
- 25.7.9 The Weekly Work Plan shall be derived from the programme submitted for acceptance.

25.8 Daily Log

- 25.8.1 For each element of the *works* being performed, the *Contractor* shall maintain a daily log to be completed and filed no later than 10.00 hours the next day, inclusive of all weekends.
- 25.8.2 Within ten (10) working days of the starting date, the *Contractor* shall submit the proposed format of the daily log to the *Project Manager* for acceptance.

25.8.3 The daily log(s) shall be made available to the *Project Manager* upon request and shall contain as a minimum:

- Daily manpower report

The report shall state the number of actual personnel on any Site during the day against that planned. For manual workers the personnel shall be grouped by trade and for non-manual workers by work title;

- Daily equipment report

The report shall indicate all actual items of Equipment and Materials or Ancillaries or Plant on any Site against that planned, and their availability for work;

- Daily construction report

The report shall include:

- (i) a brief description of the works carried out that day;
- (ii) the initiation or completion of any significant event;
- (iii) major items of Equipment and Materials or Ancillaries or Plant received, removed or installed; and
- (iv) work stoppages, interruptions, delays and potential causes of delay.

- Weather records

The report shall include a general description and any significant weather events during the course of the day.

Appendix 25.1 – Mandatory Activity Codes

All programme(s) submitted shall include as a minimum the following mandatory codes (as applicable). The *Contractor* can utilise additional activity codes as and when agreed with the *Project Manager*.

1. Lines

Value	Description
Picc	Piccadilly Line
BAK	Bakerloo Line

2. Stages (as per the TfL project management framework)

Value	Description
STG00	Stage 0 – Strategy
STG01	Stage 01 – Outcome Definition
STG02	Stage 02 - Feasibility
STG03	Stage 03 - Concept Design
STG04	Stage 04 - Detailed Design
STG05	Stage 05 - Delivery
T&C	Test & Commissioning
STG06	Stage 06 – Project Codes
STG07	Stage 07 – Benefits Realisation

3. Contract Milestone

Value	Description
SD	Start Date
KD	Key Date
MS	Milestone
AD	Access Date
SC	Sectional Functional Completion Date
SF	System Functional Completion Date
FC	Final Completion
DD	Defects Date
LD	Longstop Date
CN	Constraint

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 26

Subcontracting

Table of Contents

26.1	General	1
26.2	Glossary	1
26.3	Tender Events Schedule	2
26.4	Critical Subcontracts	2
26.5	Procurement	3
26.6	CompeteFor Electronic Brokerage Service	4
26.7	Tender Lists	5
26.8	Subcontract Selection	5
26.9	Subcontract Appointment	5
26.10	Collateral Warranties, Parent Company Guarantees and Legal Opinions	6
26.11	Supply Chain Management	6
26.12	Material Amendments	7
26.13	Termination of a Sub-Contract	7
26.14	Final Accounts	8
Appendix 26.1 – Tender Events Schedule		9
Appendix 26.2 – Subcontract Acceptance Checklist		10
Appendix 26.3 – Supply Chain Management Status Report		11
Appendix 26.4 – Status of Critical Sub-Contracts		12
Appendix 26.5 – Final Account Statement		13

26.1 General

- 26.1.1 This section further defines the specific requirements with regards to procurement and supply chain management that the *Contractor* shall comply with in the delivery of the *works*.
- 26.1.2 Procurement relates to all delivery related works and/or services in connection with and leading up to the appointment of a Subcontractor.
- 26.1.3 Supply Chain Management relates to all delivery related works and/or services following award of a commitment with a Subcontractor.
- 26.1.4 The *Contractor* shall attend a procurement and supply chain management progress review meeting with the *Project Manager* at bi-weekly intervals unless otherwise agreed with the *Project Manager*. The first meeting shall take place within six (6) weeks of the *starting date*.
- 26.1.5 The *Contractor* shall submit to the *Project Manager* at least two (2) Working Days prior to the meetings the following documents together with any necessary supporting information:
- Updated Tender Events Schedule (Appendix 26.1); and
 - Updated Supply Chain Management Status Report (Appendix 26.3).

26.2 Glossary

Term	Definition
CompeteFor	CompeteFor is a service that enables businesses to compete for contract opportunities linked to major public and private sector buying organizations.
Critical Subcontracts	<p>Any subcontract for Equipment and Materials, Plant and/or services that fulfils one or more of the following criteria (unless otherwise agreed by the <i>Project Manager</i>):</p> <ul style="list-style-type: none"> • Value of the subcontract is over £500,000; • Is on the critical path for delivery; • Has a limited or constrained supply market; • Includes highly complex product(s) with subcontract design; • Has a long lead time; and/or • Is otherwise stated to be a Critical Subcontract by the <i>Project Manager</i>. <p>If the <i>Contractor</i> proposes to subcontract the transmission design. For the avoidance of doubt, this will be a Critical Subcontract.</p>
Ethical Trading Initiative Base Code	The ETI Base Code is an internationally recognised set of labour standards based on International Labour Organisation (ILO) conventions. It is used by ETI members and others to drive improvements in working conditions around the world.

Term	Definition
Procurement Plan	The Procurement Plan demonstrates how the <i>Contractor</i> will comply with the procurement related requirements of the Works Information, and in particular the Responsible Procurement requirement
Supply Chain Management Plan	The Supply Chain Management Plan shall demonstrate how the <i>Contractor</i> will supervise and manage his supply chain which shall be aligned with the <i>Contractor's</i> Procurement Plans, such that both plans demonstrate an end to end approach to procuring and managing all subcontracts.
Tender Events Schedule	The Tender Events Schedule demonstrates the various different work package procurements that the <i>Contractor</i> plans to undertake in order to deliver the <i>works</i> .
Work Package	Is the splitting up of the scope of works into smaller packages suitable for obtaining Tenders and orders within the <i>Contractors</i> supply chain.

26.3 Tender Events Schedule

- 26.3.1 The *Contractor* shall submit an initial Tender Events Schedule to the *Project Manager* for information, within twenty (20) Working Days from the *starting date*, completed with all available information which reflects the *Contractor's* Procurement Plans for the *works*, in the form provided in Appendix 26.1.
- 26.3.2 The Tender Events Schedule shall be a 'live document' which the *Contractor* shall continue to add to or amend so that it includes all up to date information as required to complete the Tender Events Schedule. The updated Tender Events Schedule will be reviewed at the procurement and supply chain management progress review meeting with the *Project Manager*.

26.4 Critical Subcontracts

- 26.4.1 The *Contractor* determines the list of Critical Subcontracts and incorporates recognition of these on the Tender Events Schedule.
- 26.4.2 With the agreement of the *Project Manager*, any Work Package or Subcontract may become or cease to be a Critical Subcontract at any time up to and including Completion.
- 26.4.3 Critical Subcontracts will have an enhanced level of scrutiny, compared to non-critical subcontracts, over a Subcontractor's or supplier's ability to provide the *works*, financial capacity and standing.

26.5 Procurement

- 26.5.1 The *Contractor* shall prepare and submit a detailed Procurement Plan for each Critical Subcontract prior to commencing the procurement of the Subcontract for the *Project Manager's* acceptance. The Procurement Plan demonstrates how the *Contractor* will comply with the procurement related requirements of the Works Information, and in particular the Responsible Procurement requirements.

26.5.2 The *Contractor* shall include the following, as a minimum, in the *Contractor's* Procurement Plan:

- Identification of the elements of the *works* the *Contractor* intends to award externally or to Associated Companies and its strategy, having regard to the requirements in for Critical Subcontracts and the *Contractor's* Work Breakdown Structure;
- Details of the scope of any works or services to be provided under each proposed subcontract;
- Identification of subcontracts which have already been procured;
- Identification of Work Packages or subcontracts which are likely to fall within the definition of Critical Subcontracts;
- Procedures to ensure the *Contractor* plans, implements and monitors his procurement activities to achieve best value (including but not limited to):
 - applying fair and reasonable terms including payment within 30 days of receipt of undisputed invoices;
 - identifying appropriate flow down conditions
 - using accurate and up to date information;
 - through competitive tenders or, where there is no alternative to single source, using fair open market prices;
 - using an appropriate process for selection of tenderers;
 - by fairly evaluating tenders received;
 - obtaining suitable breakdown of prices; and
 - obtaining the necessary collateral warranties, parent company guarantees and legal opinions as required under a particular subcontract.
- The procedures which the *Contractor* will employ to allocate and use appropriate time for the following activities where applicable:
 - prequalification of Subcontractors or suppliers to determine tender lists, including appropriate levels of scrutiny of a tenderer's ability to deliver the proposed works, materials and/or services;
 - preparation of complete tender documentation or other form of enquiry;
 - preparation and submission of responses by tenderers;
 - tender evaluation by the *Contractor*;
 - preparation of tender report and award recommendation;
 - obtaining appropriate levels of commitment authority; and
 - proper execution of subcontract documentation.

- The control systems the *Contractor* will use to ensure that:
 - the processes adopted for the procurement of each Work Package or individual subcontract are regularly reviewed and adjustments made to ensure they remain appropriate throughout the procurement phase; and
 - purchased Equipment and Materials and Plant are specified to the required quality and ordered in the appropriate quantities for delivery at times that are aligned with the Accepted Programme.

26.5.3 The *Contractor* shall revise and update the Procurement Plan:

- as necessary to suit the *Contractor's* plans for Providing the Works; and
- as and when requested by the *Project Manager*.

26.5.4 The revised and updated Procurement Plan shall be submitted by the *Contractor* to the *Project Manager* for acceptance.

26.5.5 The *Contractor* shall comply with the latest accepted Procurement Plan.

26.5.6 The Procurement Plan shall include details of the process(es) the *Contractor* will implement to allocate and monitor relevant budgets against individual Work Packages.

26.5.7 The Procurement Plan shall include details of the procedures the *Contractor* will implement to enable diverse suppliers to become aware of opportunities. The *Contractor* will put in place strategies to ensure barriers preventing supplier opportunities are removed and assistance is provided in understanding the bidding process.

26.6 CompeteFor Electronic Brokerage Service

26.6.1 The *Contractor* shall:

- on a non-exclusive basis, use the CompeteFor electronic brokerage service, or such alternative web-based tool as the *Employer* may direct from time to time, to make available to suppliers all appropriate opportunities, arising in connection with the Order, to supply goods, works and/or services to the *Contractor*;
- use all reasonable endeavours to ensure that its Subcontractors use CompeteFor, on a non-exclusive basis, to make available to others all appropriate opportunities, arising in connection with the Order, to supply goods, works and/or services to that Subcontractor;
- monitor and maintain a record of the number, type and value of opportunities arising in connection with the Order, made available to other suppliers via CompeteFor whether by the *Contractor* or a Subcontractor, and shall report this information at the procurement and supply chain management progress review meeting with the *Project Manager*; and
- when posting opportunities on CompeteFor, the *Contractor* shall specifically reference the OPO CCTV System contract.

26.7 Tender Lists

- 26.7.1 The *Contractor* shall implement processes in accordance with his accepted Procurement Plan to ensure tender lists are comprised of suppliers with appropriate capability, capacity and financial standing for each Work Package or subcontract.
- 26.7.2 The *Contractor* shall provide the *Project Manager* the opportunity to review the proposed list of tenderers for each Work Package or subcontract in advance of issuing any invitation to tender. Any proposal to use single source shall be supported by appropriate justification from the *Contractor*.
- 26.7.3 The *Employer* is willing to support the *Contractor* when compiling tender lists and will utilise appropriate market intelligence available from within the DTUP Commercial Team to provide any further information pertaining to market capacity, capability and financial standing.
- 26.7.4 Unless otherwise agreed in advance with the *Project Manager*, any commitments made by the *Contractor* to third parties or Associated Companies should be competitively sourced by selecting the most economically advantageous tender. The *Contractor* shall ensure and evidence value for money in each and every procurement.

26.8 Subcontract Selection

- 26.8.1 Where subcontract appointments are subject to the *Project Manager's* acceptance, the *Contractor* shall submit all proposed documentation to the *Project Manager* for review and comment prior to release to bidders. The *Project Manager* will respond within six (6) weeks to accept or reject the documentation.
- 26.8.2 The *Contractor* shall work with the *Project Manager* and his representatives to agree, within twenty (20) weeks of the *starting date*, standard template forms of subcontract. These will include a number of flow-down clauses from the Implementation Works Terms to be used by the *Contractor* to appoint Subcontractors. Each appointment to be made using any accepted template form will be subject to the *Project Manager's* acceptance of the elements specific to those subcontracts.

26.9 Subcontract Appointment

- 26.9.1 The *Contractor* shall not award any subcontract to any third party or Associated Company without the prior acceptance of the *Project Manager*.
- 26.9.2 The *Contractor* shall use the template pro-forma Subcontract Acceptance Checklist provided in Appendix 26.2 for the submission of proposed Subcontractor names, subcontract details and all necessary supporting information as required.
- 26.9.3 Once acceptance has been provided by the *Project Manager*, the *Contractor* shall formalise the subcontract and unless otherwise agreed, provide a conformed final copy to the *Project Manager* within ten (10) Working Days after execution of the agreement between the *Contractor* and the Subcontractor or supplier.

26.10 Collateral Warranties, Parent Company Guarantees and Legal Opinions

26.10.1 The *Contractor* shall ensure that all collateral warranties, parent company guarantees and legal opinions are provided to the Subcontractor for execution at the same time as the subcontract form and that they are then provided to the *Project Manager* for execution by the Employer within twenty (20) Working Days of execution of each subcontract.

26.11 Supply Chain Management

26.11.1 The *Contractor* shall prepare and submit for the *Project Manager's* acceptance a detailed Supply Chain Management Plan, within forty (40) Working Days of the *starting date*. The *Contractor* shall update the Supply Chain Management Plan annually, and provide to the *Project Manager* for acceptance.

26.11.2 The Supply Chain Management Plan shall demonstrate how the *Contractor* will supervise and manage his supply chain which shall be aligned with the *Contractor's* Procurement Plans, such that both plans demonstrate an end to end approach to procuring and managing all subcontracts.

26.11.3 The Supply Chain Management Plan will include the following (as a minimum):

- Procedures to ensure the *Contractor*:
 - administers his subcontracts in accordance with the terms of each specific subcontract;
 - pays Subcontractors and suppliers within thirty (30) days of receipt of undisputed valid invoices;
 - controls and implements any necessary compensation events/variations/changes to awarded contracts including appropriate authorisation of changes;
 - records and reports the status of all subcontracts to the *Project Manager* at the regular Procurement & Supply Chain Management progress review meetings with the *Project Manager* using the Supply Chain Management Status Report included within Appendix 26.3;
 - records the status of each Critical Subcontract in the form of a report included within Appendix 26.4 and submits those reports to the *Project Manager* for information at quarterly intervals;
 - complies with, and ensures that its Subcontractors comply with, or are working towards complying with, the principles of the Ethical Trading Initiative Base Code;
 - registers with an ethical supplier database, such as SEDEX (Supplier Ethical Data Exchange) and until Completion permits and enables the *Project Manager* to have access to the information that subsists in such ethical supplier database.
- Control systems to ensure that:
 - the *Contractor* records the receipt of Equipment and Materials and Plant delivered to Site, including identification of any defects in quality and/or quantity;
 - measures are implemented for the proper storage, maintenance and issue for use of all Equipment and Materials and Plant; and

- Equipment and Materials received on Site is effectively and economically employed for the execution of the *works*.

26.11.4 The *Contractor* shall revise and update the Supply Chain Management Plan to suit the *Contractor's* plans for providing the *works*. The revised and updated Supply Chain Management Plan shall be submitted by the *Contractor* to the *Project Manager* for acceptance. The *Contractor* shall comply with the latest accepted Supply Chain Management Plan.

26.12 Material Amendments

26.12.1 The *Contractor* shall pay any undisputed sums which are due from it to a Subcontractor or supplier within thirty (30) Working Days from the receipt of a valid invoice.

26.12.2 The *Employer* shall be entitled to publish the details of any late or non-payments (including on government websites and in the press).

26.12.3 The *Contractor* shall prepare and maintain a Supply Chain Management Status Report, using the template form included in Appendix 26.3, to monitor and record at summary level the status of each awarded subcontract. The *Contractor* shall provide this report to the *Project Manager* for review at the procurement and supply chain management progress review meetings.

26.13 Termination of a Sub-Contract

26.13.1 The *Contractor* shall not terminate any subcontract without the *Project Manager's* prior written consent (which shall not be unreasonably withheld or delayed).

26.13.2 The *Employer* may require the *Contractor* to terminate or request its Subcontractor terminates:

- a subcontract where:
 - the acts or omissions of the relevant Subcontractor have caused or materially contributed to an *Employer* right of termination, whether or not the *Employer* proposes to exercise that right of termination;
 - the relevant Subcontractor or any company in the same group of companies as the Subcontractor brought the *Employer* into disrepute by engaging in any act or omission which is reasonably likely to diminish the trust and reputation that the public places in the *Employer*, regardless of whether or not such act or omission is related to the Subcontractor's performance of its subcontract;
 - the relevant Subcontractor has failed to comply in the performance of its subcontract with legal obligations in the fields of health and safety, environmental, social or labour law; or
 - a right arises in relation to the Subcontractor pursuant the prevention of fraud and bribery.
- a Critical Subcontract where there is a Change of Control of the relevant Subcontractor, unless:
 - the *Employer* has given its prior written consent to the particular Change of Control, which subsequently takes place as proposed; or
 - the *Employer* has not served its notice of objection within twenty four (24) weeks of the later of the date the Change of Control took place or the date on which the *Employer* was given notice of the Change of Control.

26.14 Final Accounts

- 26.14.1 The *Contractor* shall support Subcontractors in progressively assessing amounts due to enable Subcontractors and suppliers to align with the final account process between the *Project Manager* and the *Contractor*. The *Contractor* shall co-operate in populating and agreeing the final account statement between the *Project Manager* and the *Contractor* in a form substantially similar to that in Appendix 26.5.

Appendix 26.1 – Tender Events Schedule

See document titled *“Appendix_26.1_-_Tender_Events_Schedule_Template.xlsx”*

Supporting Instructions and Definitions:

In the Tender Events Schedule and these instruction references to “**subcontract**” shall include subcontract, supply contract, contract for services or other contractual commitment between the *Contractor* a third party or Associated Company.

Each row in the above table will contain information for all individual proposed sub-contracts. The following definitions identify the information to be inserted within each column:

A - Work Package Reference = Unique reference allocated to each Work Package in accordance with the Contractor’s accepted work breakdown structure (WBS).

B - Work Package & Subcontract Description = A brief description of the Work Package and scope of the specific subcontract proposed.

C – Not Used.

D – Estimated Subcontract Value = The *Contractor’s* forecast of the total value of the listed subcontract.

E – Allocated Budget = The value within the *Contractor’s* target price (including the *Contractor’s* risk allowance where appropriate) for the specific subcontract scope allocated in accordance with the *Contractor’s* programme controls procedures.

F – Critical Subcontract = Inserting a ‘Y’ identifies those subcontracts which have been classed as Critical Subcontracts. An ‘N’ identifies all other subcontracts.

G – CompeteFor Opportunity posting date = The forecast or actual date on which the *Contractor* will post or has already posted the opportunity on the electronic brokerage service CompeteFor for the specific subcontract. This date should be a minimum of 20 Working Days prior to the intended date for issue of any enquiry to provide those organisations interested in being considered sufficient time to express their interest and allow the *Contractor* to complete any necessary pre-qualification process prior to determining the tender list.

H – Supplier(s)/Subcontractor(s) for tender list = Identifies all organisations being considered for inclusion on the tender list or who have been issued with a request for tender, quotation or equivalent.

I – Company Registration Number(s) = The Companies House registration number (or equivalent) for, and identified against, each of the organisations inserted in the previous column.

J – Procurement Route (ITT/FA) = The method the *Contractor* proposes using or has used to select a Subcontractor or supplier for the award of the specific subcontract applying the principles of MEAT (Most Economically Advantageous Tender), e.g. single or two stage tender, framework, quotation, etc.

K – Proposed Form of Contract = The form of subcontract, supply contract or contract for services including identification of specific main options (e.g. NEC PSC) the *Contractor* proposes to use in the engagement of the Subcontractor or supplier to be appointed for the specific subcontract. (The *Contractor* is reminded of the requirement in clause 26.2 of the Master conditions of contract to utilise NEC forms where appropriate.)

L – Commercial Model = The overall commercial arrangement for the allocation of risk and responsibility within the proposed subcontract, e.g. target cost, lump sum, remeasure (e.g. using Bill of Quantity), etc.

M – Enquiry documentation submitted to the *Project Manager* = The date on which the *Contractor* proposes or has already submitted a full set of draft tender or other enquiry documentation to the *Project Manager*.

N – Enquiry Issue Date = The date on which the *Contractor* proposes to issue or has already issued the invitation to tender or other enquiry to those organisations being invited to submit a tender response or quotation.

O – Enquiry Response Date = The date on which the *Contractor* expects to receive or has already received responses to the enquiry issued on the date identified within the previous column.

P – Date sent to *Project Manager* for acceptance of appointment = The date the *Contractor* proposes or has already sent his request for *Project Manager's* acceptance to appoint the proposed Subcontractor or supplier for the specific subcontract in accordance with clauses 26.2 of the Master Conditions of Contract. This is the date when the complete draft subcontract, supply contract or contract for services is to be or has been submitted to the *Project Manager*.

Q – *Project Manager* acceptance of proposed Subcontractor = The date on which the *Contractor* anticipates or has already received the *Project Manager's* acceptance of the proposed appointment as required by clauses 26.2 of the Master Conditions of Contract. When inserting this date, the *Contractor* shall respect the period for reply as measured from the date inserted in the previous column for the submission of his request for acceptance. Forecast dates shall be separately identified from actual dates where those forecast dates have already passed and the *Project Manager's* acceptance has not been obtained for any reason. Further statements should be provided within the comments column to explain these types of difference.

R – Successful Supplier/Subcontractor = Identifies the organisation to be appointed or already appointed for the specific subcontract following the *Contractor's* receipt of the *Project Manager's* acceptance.

S – Value of Awarded Contract = The *tendered total of the Prices*, or its equivalent, to be included or already included within the awarded subcontract, supply contract or contract for services.

T – Target Award Date = The date on which the *Contractor* forecasts awarding the specific subcontract. This date should only be amended in accordance with the Accepted Programme and so will be treated as a baseline target date. Any forecast or actual deviation from this baseline date will be reviewed as part of the *Project Manager* and *Contractor's* regular joint procurement review process(es).

U – Actual Award Date = Inserted when the specific subcontract was formally awarded as the date upon which the subcontract was executed.

V – Subcontract Start Date = The *Contractor's* forecast of the starting date of the specific subcontract or where executed the starting date included within the awarded subcontract.

W – Subcontract Completion Date = The *Contractor's* forecast of the completion date of the specific subcontract or the completion date included within the executed subcontract. Deducting the starting date from this date gives the expected duration of the specific subcontract.

X – Final conformed copy of Subcontract provided to *Project Manager* = The date on which the *Contractor* forecasts providing, or the date on which the *Contractor* has already provided, a copy of the executed subcontract to the *Project Manager*.

Y – Impact on other Orders = Inserting a 'Y' identifies those subcontracts which have or may have an impact on the *Contractor's* procurement activities on other Orders. (Examples may be where common components or designs are utilized across multiple Orders and the selection of a Subcontractor or supplier may generate a commitment greater than that associated with this particular Order.)

Comments = Statements supporting or explaining information inserted in, or absent from, the other columns.

Appendix 26.2 - Subcontract Acceptance Checklist

See document titled “Appendix_26.2_-_Subcontract_Acceptance_Checklist.xlsx”

SUB-CONTRACT ACCEPTANCE CHECKLIST		VERSION (revision)	DATE	PURPOSE STATUS	OWNER	ROLE
CONTRACT:	CXXXX (Insert Package Ref) XXXXXXXXXXXXX (Insert Package Title)					
PROPOSED SUB-CONTRACTOR:	(Insert specific name of proposed contracting entity)					
PROPOSED SUB-CONTRACTOR WORKS						
	Description: (Insert brief description to identify the scope of the Sub-contract Works)					
	Proposed Award Value: £XX,XXX,XXX.XX (Insert proposed tendered total of the Prices of equivalent)					
ITEM	REQUIREMENTS	CONFIRM Y or N	ENDORSED BY Name of Contractor's representative	ITEM IN SUB-CONTRACT SUPPORTING THE CONFIRMATION	EVIDENCE Supporting Documents (where required)	COMMENTS
1.00	Contractor's Assurance - Section 1.01 to be endorsed by appropriate authority for ALL proposed Sub-contracts					
1.01	Contractor to confirm it has undertaken the procurement and selection process in accordance with the Contractor's accepted Procurement Plan and has applied all due processes and procedures as required to meet the requirements of its contract with the Employer and in accordance with the Works Information					
2.00	CONTRACTOR to further confirm that: Section 2.01 has been endorsed by appropriate authority for ALL proposed Sub-contracts					
2.01	The Sub-contract shall be confirmed and executed fully in accordance with the Employer's form of NEC subcontract as provided in _____ of the contract - If NOT confirmed, refer to item 3.01 below.					
2.02	The Sub-contract scope is fully detailed with all relevant specifications, drawings and associated documents contained within the proposed Sub-contract			(Only relevant if Employer is providing his own form of NEC Sub-contract)		Contractor shall state the Contract Form and Main Option - i.e. Lump Sum/Target Cost/Cost Reimbursable/Purchase Order etc...
2.03	The proposed Sub-contractor has been appropriately briefed on the full scope of the Contractor's Works, the purpose of its proposed engagement and the manner in which the Sub-contract Works will be integrated as part of the Contractor's Works/Services.					
2.04	The proposed Sub-contractor can provide the Sub-contract Works in accordance with the Sub-contract Works Information.					
2.05	The proposed Sub-contractor has been made fully aware of all constraints associated with the project and the Sub-contract Works.					
2.06	The Sub-contract includes clear definitions of attendances and interfaces with Others.					
2.07	The Sub-contract incorporates the Employer's requirements on Health, Safety, Environment and Quality.			(These should capture all the necessary flow downs, particularly if clause 26 is going to director Contractor on what to flow down to particular categories of Sub-contract, as was the case in clause 35 of the original main contract form)		
2.08	The Sub-contract incorporates the Employer's requirements on Responsible Procurement.					
2.09	The Sub-contract incorporates the Employer's requirements on Work Related Road Risk.					
2.10	The Sub-contractor has been suitably briefed on _____.			(This should capture any specific characteristics of the project the Employer and/or PM want to make sure the Sub-contractor is aware)		
2.11	There is NO Sub-contract design element to the Sub-contract Works - If NOT confirmed (i.e. There IS a design component to the Sub-contract Works) refer to item 4.04 below.					
3.00	CONTRACTOR to submit for Project Manager's review:					
3.01	In the event the Contractor proposes to change to the Employer's form of NEC Sub-contract that's provided in _____ of the Contract, or other terms of contract are proposed, then the Contractor shall provide full details of the proposed Sub-contract terms for the Project Manager's review and acceptance			(Only relevant if Employer is providing his own form of NEC Sub-contract)		
3.02	Evidence of proposed Sub-contractor's capabilities to perform works of this nature (company literature /brochures, references or other evidencing capabilities on works of a similar nature).					
3.03	Full details of the proposed Sub-Contractor's schedule (programme) and confirmation that the Sub-contract Works shall be undertaken to align with the current Accepted Programme.					
3.04	A copy of the completed Contract Data for the proposed Sub-contract.					
3.05	Proposed Activity Schedule (or equivalent) together with a suitable breakdown of prices.					
3.06	Copies of proposed insurance documents as appropriate to cover the Sub-contract Works.					
3.07	The Sub-contract contains requirements for PCG/Bond and they will be provided in the form required.					
3.08	Submitted information detailing the proposed Sub-contractor's Health & Safety record.					

3.09	Proposed Sub-contractor's delivery organisation chart & key persons CVs as appropriate.					
3.10	Proposed Site Information to be included with the Sub-contract.					
4.00	CONTRACTOR to provide evidence that:					
4.01	The Sub-contract has been procured for open market or competitively tendered prices with deductions for discounts, rebates and taxes which can be recovered as required by of the Contract. The Contractor is to provide a summary of the process adopted for the selection of the proposed Sub-contractor including the main decisions made with reasons given for each. In the event of a single procurement route being applied, the Contractor must show the basis for its decision and shall be obliged to demonstrate that such decision has due merit and it not in breach of its obligations under the Contract or any duty at law.					
4.02	Appropriate credit checks and other financial ratings as appropriate have been carried out on the proposed Sub-contractor and that these have been provide for satisfactory returns with appropriate securities to be obtained.					
4.03	CompeteFor sourcing tool has been utilised as required by the Works Information.					
4.04	In the event the Sub-contract Works include an element of design to be undertaken by the Sub-contractor, collateral warranties and associated PCG and legal opinions shall be provided as required by the Contract.					
4.05	In the case of a Sub-contractor providing the software, other than Off the Shelf Software, for incorporation into or operation of the works the Sub-contractor will enter into a software escrow agreement in the required form as per the Contract.					

Appendix 26.4 – Status of Critical Sub-Contracts

1.0 - Interim Payment							
1.1 Provide a copy of the latest Activity Schedule is use on this subcontract.						Document Ref:	
1.2 Provide the following data related to Interim Payments							
	Amounts included per period	Subcontractor's Application	Contractor's Assessment	Amounts withheld	Amount Paid		
	Payment No 1						
	Payment No 2						
	Payment No 3						
	Etc..						
	Totals	£ -	£ -	£ -	£ -		
1.3 What measures are in place for monitoring progress and establishing completion of activities triggering payment?							
1.4 What periodic progress reports are prepared and what happens to the data produced? How does it feed into Contractor's reporting on the main contract?							
2.0 - Change Management/Administration							
2.1 Provide the following data related to management of change in the administration of the subcontract							
		Subcontract Ref: (NCE or equivalent):	Description	Main Contract ref: (if any)	Programme impacts	Cost impacts	Total Estimated Cost at Completion (EAC)
	Initial Contract Sum						£ 250,000
	Change Ref 1	Example 1	Add - XXXX	NCE-XXX	None	£ 10,000	£ 260,000
	Change Ref 2	Example 2	Omit - XXX	NCE-XXX	None	-£ 25,000	£ 235,000
	Change Ref 3	Example 3	Possible delay	EWN-XXX	Possible 10 day delay	£ 50,000	£ 285,000
3.0 - Early Warnings (or their equivalent) and Risk Management						Document Ref:	
3.1 Is there a Subcontract Risk Register?					Yes/No		
4.0 - Subcontractor's Programme Management						Document Ref:	
4.1 Is there a current up to date Accepted Programme or equivalent?					Yes/No		
5.0 - Key People (or equivalent)							
5.1 Have key people named in Subcontract data actually been provided? Include details of any changes (accepted or otherwise).					Yes/No		
6.0 - Sub-subcontractor Approval							
6.1 Has the Subcontractor appointed any Sub-subcontractors? Include details of status of Contractor's acceptance or otherwise.					Yes/No		

Appendix 26.5 – Final Account Statement

See documents titled “*Appendix_26.5_-_Final_Account_Letter.docx*” and “*Appendix_26.5_-_Final_Account_Statement.xlsx*”

Employer: [insert contracting entity e.g. LUL]
Project: [insert project title]
Contract: [insert contract title]
Contractor: [insert name of supplier]
Contract No: [insert number] (“this Contract”)

Gross Final Account Value	£	0.00
Less: Discount:		0.00
Less: Agreed Contra Charges:		0.00
Less: Previous Payments:		<u>0.00</u>
<u>Final Amount Due (Excluding VAT):</u>		0.00

The *Contractor* agrees that the Gross Final Account Value represents the full and final extent of the Client’s financial liability to the Contractor under, arising out of, or in connection with this Contract. The *Contractor* acknowledges it has no further claims of any nature whatsoever, under, arising out of, or in connection with this Contract.

The Gross Final Account Value is full and final payment for all works properly undertaken in accordance with this Contract. Nothing in this Final Account Statement shall be considered a waiver by the *Employer* of, or in any way prejudice to, its rights or remedies under this Contract, the terms and conditions of which shall remain in effect.

Any payment made by the *Employer* under this Contract, including the final payment, does not prevent the *Employer* from recovering any amount overpaid or wrongfully paid however such payments have arisen, including but not limited to those amounts paid to the Contractor by mistake of law or fact.

The *Contractor* remains liable for any defects specifically identified under the terms of this Contract or common law.

This Final Account Statement is certified when it is signed by authorised representatives of the *Contractor* and the *Employer*. Payment of the Final Amount Due will be made by the *Employer* following certification (less any retention to be held under this Contract) and by the final date for payment stipulated within this Contract. Any retention will be released by the *Employer* in accordance with this Contract or released twelve months after completion if no release date is stated within this Contract.

The *Contractor* acknowledges acceptance of the Gross Final Account Value and these terms by signing and returning to the *Employer* as appropriate this Final Account Statement.

Please refer to the accompanying detailed Final Account Statement form in excel providing backup to this summary statement.

Authorised Signature for the *Contractor*: _____

Print Name: _____

Position: _____

Date: _____

Authorised Signature for the *Employer*: _____

Print Name: _____

Position: _____

Date: _____

Final Account Statement

FORECAST OUT-TURN (Contracted Scope Only)

Deep Tube Upgrade Programme - OPO CCTV System

TARGET PRICE		Project Manager		Contractor	Commentary
1 Tendered Total of the Prices			<i>Forecast Total Prices</i>	<i>Forecast Total Prices</i>	
2 Price Adjustments					
2a Level 1 - CE Implemented, PM accepts Contractor's quotation		£0			£0
2b Level 2 - CE Implemented, Project Manager's Assessment		£0			£0
4 PAF to Date on PWDD		£0			£0
5 Reduced Prices for Defects Acceptance		£0			£0
6 Current Total of the Prices		£0	£0	£0	£0
7 Level 3 - CE Accepted by PM but not yet Implemented		£0			£0
8 Level 4 - CE Notified but pending Acceptance / Rejection		£0			£0
9 Level 5 - CE Rejected by the PM		£0			£0
12 PAF to Go on remaining PWDD		£0			£0
13 Reduced Prices for Defects Acceptance		£0			£0
14 Anticipated Further Target Adjustments		£0			£0

DEFINED COST					
15 Cost Incurred to Date (PM's Payment Cert)		£0	<i>Forecast PWDD</i>	<i>Forecast PWDD</i>	£0
18 Less Disallowed Costs to Date		£0			£0
19a Contractor's fee	0.00%	£0			£0
20 PWDD		£ -			£ -
21 Cost to Go (at today's prices)		£0			£0
23 Opportunities Cost Reduction / Other Potential Savings		£0			£0
24 Less Forecast of Potential Disallowed Costs to Go		£0	£0	£0	£0
25 Forecast Inflation of Cost to Go		£0			£0
27a Contractor's Fee percentage	0.00%	£0			£0
28 Anticipated Further PWDD		£0			£0
29 Summary Total (Total PWDD pre Fee adj.)		£ -			£ -
30g PWDD other non payable Fee	-	£0			£0
30 PWDD Total Fee adjustment (-)	-	£0			£0

SHARE MECHANISM (53)					
31 Forecast Contract Pain/Gain		£0	<i>Forecast Share</i>	<i>Forecast Share</i>	£0
31a Update with DTUP P/G	50%	£0			£0
31b		£0			£0
31c		£0	£0	£0	£0
31d		£0			£0
31e		£0			£0
31f		£0			£0
31g		£0			£0
31h		£0			£0

NON TARGET PRICE WORKS - VOWDD			Forecast VOWDD		Forecast VOWDD	
32	Post Completion Cost incurred to Date (if contract allows for non- target price works)	£0				£0
34a	fee percentage	0.00%			0.00%	£0
35	Non Target Price Works - VOWDD	£0				£0
36	Post Completion Cost to Go (if contract allows for non- target price works)	£0				£0
38c	Contractor's fee percentage	0.00%	£0	£0	0.00%	£0
39	Non Target Price Works - Anticipated Further VOWDD	£0				£0
40a	VOWDD non payable Margin Fee Component	-			-	£0
40c	VOWDD other non payable Fee	-			-	£0
40	VOWDD Total Fee adjustment (-)	-			-	£0
41 AMOUNT DUE (excluding Other Amounts)			£0	£0		
			Variance from PM Assessment			
			£0			
OTHER AMOUNTS DUE (subject to VAT)						
42	Amounts Due to the Contractor	£0	£0	£0		£0
43	Amounts Due to the Employer (exclduing Damages)	£0				£0
OTHER AMOUNTS DUE (not subject to VAT)						
44	Amounts Due to the Contractor	£0	£0	£0		£0
45	Amounts Due to the Employer (exc Damages)	£0				£0
FORECAST DAMAGES						
25	Unliquidated Damages	£0	£0	£0		£0
26	Liquidated Damages	£0				£0
FORECAST NET FINAL PAYMENT CERTIFICATE			£0	£0		
			Variance from PM Assessment			
			£0			

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 27

Responsible Procurement

Table of Contents

27.1	General	1
27.2	Glossary	1
27.3	Responsible Procurement Policy	2
27.4	Responsible Procurement and Sustainable Delivery	3
27.5	Responsible Procurement Plan	3
27.6	Strategic Labour Needs and Training (SLNT)	3
27.7	SLNT Plan	4
27.8	SLNT Coordinator	8
27.9	Training of Apprentices and Trainees	8
27.10	Supporting Centers of Excellence	9
27.11	Monitoring and Reporting	9
27.12	Equality, Diversity and Inclusion (EDI) Action Plan	10
Appendix 27.1	Strategic Workforce Output Breakdown	13
Appendix 27.2	SLNT Activity Breakdown Table	17
Appendix 27.3	Quarterly Strategic Workforce Monitoring Report	18

27.1 General

This section further defines the specific requirements with regards to Responsible Procurement and the obligations that the *Contractor* shall comply with in Providing the Works.

27.2 Glossary

Term	Definition
Apprentice	means a member of the <i>Contractor's</i> staff who is registered as an apprentice or technician with an industry recognised body.
<i>Employers</i> Supplier Skills Team	a function within the <i>Employers</i> organization who can provide guidance on SLNT principles.
Equality, Diversity and Inclusion (EDI) Action Plan	a plan provided by the <i>Contractor</i> which outlines how it will meet the EDI objectives and adhere to the GLA Responsible Procurement Policy.
Greater London Authority (GLA)	the local government body responsible for the Greater London area, as explained in the GLA Act 1999.
Strategic Labour Needs Training (SLNT) Plan	a plan provided by the <i>Contractor</i> which outlines the SLNT outputs it will use in order to meet the <i>Employers</i> SLNT requirements.
Quarterly SLNT Monitoring Report	means the report to be prepared by the <i>Contractor</i> in the form set out at Appendix 27.3 and submitted to the <i>Project Manager</i> .
Relevant Employment Vacancy	means an employment vacancy within the <i>Contractor's</i> organisation for a member of <i>Contractor</i> Personnel.
Responsible Procurement Policy (RPP)	the strategic policy provided by the GLA that sets out its plans, ambitions and commitments for ensuring continuous improvement in London, delivered through their procurement activities.
Small to Medium Enterprises (SMEs)	a small or medium-sized enterprise, or SME, as defined by the European Commission is a business or company: <ul style="list-style-type: none"> • that has fewer than 250 employees; and • has either (a) annual turnover not exceeding €50 million (approximately £40 million) or (b) an annual balance-sheet total not exceeding €43 million (approximately £34 million)

Strategic Labour Needs and Training (SLNT) Coordinator	is part of the <i>Contractor's</i> team and is responsible for the implementation and on-going development and maintenance of the SLNT Plan; and acts as the single point of contact with the Employer's staff on all matters concerning the SLNT Plan.
Strategic Labour Needs and Training (SLNT) Output	means the minimum number of Apprentice positions or equivalent to be delivered by the <i>Contractor</i> (either directly through its own personnel and the personnel of its Subcontractors) under this Agreement, as identified and agreed in the SLNT Plan.
Trainee	means a member of the <i>Contractor's</i> staff who is registered as a trainee with an industry recognised body.

27.3 Responsible Procurement Policy

27.3.1 The *Contractor* complies with the requirements and principles of the Responsible Procurement Policy in accordance with the following;

27.3.2 The Greater London Authority (GLA) has developed a Responsible Procurement Policy (RPP) through which it aims to improve London's sustainability across the following themes:

- Enhancing Social Value
- Encouraging Equality and Diversity
- Embedding Fair Employment Practices
- Enabling Skills, Training and Employment Opportunities
- Promoting Ethical Sourcing Practices
- Improving Environmental Sustainability

27.3.3 These themes are set out in more detail on the GLA public websites which may be accessed using the following link:

<https://www.london.gov.uk/decisions/md2019-gla-group-responsible-procurement-policy>

27.4 Responsible Procurement and Sustainable Delivery

27.4.1 The *Employer* is committed to responsible procurement and sustainable delivery and therefore requires the *Contractor* to adopt and implement practices and procedures which actively support the GLA's RPP.

27.5 Responsible Procurement Plan

27.5.1 Within twenty (20) Working Days of the *starting date* the *Contractor* shall submit to the *Project Manager* for acceptance, a Responsible Procurement Plan setting out his proposed arrangements in respect of the GLA RPP. In the event that any Responsible Procurement Plan submission is found to be inadequate, the *Contractor* implements an improvement plan to bring the policy arrangements to an acceptable standard within an agreed timescale. The *Contractor* resubmits the Responsible Procurement Plan until it is acceptable.

27.5.2 Thereafter, to maintain the policy in operation for the duration of the *works*, the *Contractor* and the *Project Manager* will jointly review the Responsible Procurement Plan at six (6) month intervals and any revisions to the plan will be submitted by the *Contractor* to the *Project Manager* for acceptance.

27.6 Strategic Labour Needs and Training (SLNT)

27.6.1 General

This section describes the management tasks that are required to be carried out by the *Contractor* in order to support the *Employer* to contribute towards implementing the UK Government's "Transport Infrastructure Skills Strategy" and "Transport Infrastructure Skills Strategy – Two Years on".

Transport Infrastructure Skills Strategy:

<https://www.gov.uk/government/publications/transport-infrastructure-skills-strategy-building-sustainable-skills>

Transport Infrastructure Skills Strategy – Two Years on:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727118/transport-infrastructure-skills-strategy-two-years-on-summary.pdf

27.6.2 Transport Infrastructure Skills Strategy

The *Employers* strategic workforce planning requirements reflect the recommendations of the Transport Infrastructure Skills Strategy. The strategy outlines the need to build sustainable skills in the transport and infrastructure sector, and commits to:

- Delivering 30,000 new apprenticeships by 2020, reflecting the government's overall apprenticeship target and funding from the apprenticeship levy.
- Ensuring the right mix of apprenticeships is on offer for the sector, including many at higher levels.

- Meeting the challenge of new technologies by upskilling the existing workforce.
- Promoting transport and engineering as a career of choice for the brightest and best.
- Encouraging greater diversity in the workforce, setting an ambition for:
 - (i) 20% of new entrants to engineering and technical apprenticeships in the transport sector to be women by 2020, and to achieve parity with the working population at the latest by 2030.
 - (ii) A 20% increase in the number of BAME candidates undertaking apprenticeships by 2020.

27.6.3 In Providing the Works, the *Contractor* must work collaboratively with the *Employer* and wider transport industry to address critical skills challenges within the rail engineering sectors including in particular:

- Technology change;
- Lack of diversity;
- Increase demand for rail; and
- Improve productivity.

27.6.4 The *Contractor* will set out its approach to addressing these matters in the SLNT Plan.

27.7 SLNT Plan

27.7.1 Within sixty (60) Working Days of the *starting date*, the *Contractor* shall produce and submit to the *Project Manager* for acceptance a Strategic Labour Needs and Training (SLNT) Plan.

27.7.2 The SLNT Plan shall as a minimum:

- (a) be based upon the principles and approach set out in the Transport Infrastructure Skills Strategy and demonstrate how workforce planning for the works will utilise the approaches and partnerships identified in the Transport Infrastructure Skills Strategy;
- (b) determine the minimum number of SLNT Outputs for the Order. The minimum number of SLNT Outputs shall be based on the total of the Prices and be calculated using a ratio of 1 Output per £2 million;
- (c) detail the breakdown of the SLNT Outputs in accordance with the guidance in Appendix 27.1;
- (d) plan the delivery of the SLNT Outputs against:
 - the Accepted Programme for the Order;

- the Tender Events Schedule for the Order where works are to be sub-contracted;
- the *Contractor's* Organisation Chart; and
- describe the steps the *Contractor* will take to deliver the SLNT Outputs.

27.7.3 The *Contractor* shall submit the detailed format of the SLNT Plan to the *Project Manager* for initial review within thirty (30) Working Days of the *starting date*. The SLNT Plan shall include the following minimum content:

Section	Outline Contents
Vision	Outline the overall vision for the Strategic Workforce Plan and how it will align to the <i>Contractor's</i> Project Execution Plan.
Market skills shortages and demand	Outline the <i>Contractor's</i> understanding of market supply and demand for the skill areas required to deliver the <i>works</i> .
Project Skills Requirements	<ul style="list-style-type: none"> • The skills and resource profile for the Order, based upon the <i>Contractor's</i> resource loaded programme; • The number and breakdown of SLNT Outputs to be delivered under the Order using the template in Appendix 27.2; and • The profile of SLNT Output delivery through the Order.
Approach to Delivery	<ul style="list-style-type: none"> • Describe the activities which will be undertaken in each of the SLNT Output areas against the categories in Appendix 27.1 and <ul style="list-style-type: none"> i. The qualifications and training programmes identified; ii. Named staff resource to be deploying to support the activity; iii. Assumptions made in preparing proposed activities; and iv. Any input required from the <i>Employer</i> to undertake the activities.
Enabling a Diverse Workforce	<ul style="list-style-type: none"> • The <i>Contractor's</i> approach to embedding positive equality and diversity approaches into the SLNT Plan to attract and retain diverse candidates, help address skill shortage areas and work towards meeting the Transport Infrastructure Skills Strategy commitments; • This shall include: <ul style="list-style-type: none"> i. an outline of the <i>Contractor's</i> comprehensive equality policy covering race, gender, disability, age, faith and sexual orientation in line with current legislation and codes of practice issued by the Equality and Human Rights commission; ii. the recruitment policies and procedures which exclude practices that are discriminatory, create unfair conditions of employment or create unequal rates of pay, particularly between men and women; iii. the approach to ensuring any publicity for vacancies will encourage applicants from equality target groups where there is evidence of gaps existing;

Section	Outline Contents
	<ul style="list-style-type: none"> iv. engagement, attraction, retention and development strategies for candidates from underrepresented groups; v. the procedures by which recruitment processes are regularly reviewed to ensure that all potential barriers to recruitment, particularly with regards to equality target groups, are removed
Supply Chain	<ul style="list-style-type: none"> • The key skills areas which will be sub-contracted; • The approach to ensuring Subcontractors support the delivery of the SLNT Plan; • How SLNT considerations will be included in the procurement and management of Subcontractors; and • How Subcontractors will be made aware of appropriate support and funding streams from the <i>Employer</i> and government for any SLNT activity they will be undertaking towards the <i>Contractor's</i> SLNT outputs.
Quality	The approach to ensuring apprenticeship schemes, training programmes and employment are of good quality and line with national standards.
Supporting Sector Centres of Excellence	<ul style="list-style-type: none"> • The approach to engaging with one or more of the identified sector centres of excellence and what training will be delivered through these centres; • Where the identified sector centres of excellence will not be used, details of the training provider that will be used and the reasons for selecting this provider instead of using a centre(s) of excellence. • This shall include: <ul style="list-style-type: none"> i. What centre(s) of excellence will be used; ii. What training will be delivered through the centre(s); iii. Indicative number of learners which will receive training at the centre(s); iv. When the training is scheduled.
Funding and Support	The approach to accessing available government or wider funding sources to support the SLNT Plan.
Partnerships and Collaboration	The partners with <i>Contractor</i> will work with to deliver the SLNT Plan including training organisations, government bodies and sector skills councils.
Monitoring and Reporting	The processes and systems which will be put in place to track and report on progress in delivery of the SLNT Outputs.

27.7.4 When referring to the approach to delivery in the SLNT Plan, the *Contractor* shall provide a narrative of how it proposes to address the following activities for each output type:

(a) Apprentice Job Start – New Entrant

- Attraction and recruitment
- Apprenticeship frameworks & standards
- Training provider
- Funding
- Apprentice welfare – terms, conditions and benefits

(b) Apprentice Job Start – Social Mobility

- Attraction and recruitment
- Apprenticeship frameworks & standards
- Training provider
- Funding
- Apprentice welfare – Terms, Conditions and Benefits
- Engagement with charities and referral partners

(c) Apprentice Start – Existing Staff

- Generating interest in the existing workforce
- Apprenticeship frameworks & standards
- Training Provider
- Funding

(d) Apprentice Success – Completion

- Support provided to ensure timely completion of the apprenticeship
- Career pathways and opportunities available for successful Apprentices
- How Apprentices that are not retained are supported into work upon completion of the apprenticeship

(e) Job Start - Social Mobility

- Target groups or priorities
- Possible job roles available

- Training and support to retain the job start
- Charities and partner engagement to find suitable candidates

(f) Targeted Placement Positions

- The target group(s) and the method of finding the candidates
- Placement objectives
- Typical length and type of placement

(g) Placement Positions

- The target group(s) and the method of finding the candidates
- Placement objectives
- Typical length and type of placement

(h) Educational Engagement

- The target educational establishments
- Objectives of engagement
- Engagement activities

27.7.5 The *Contractor* shall review and, if necessary, revise the SLNT Plan annually on the date of the first accepted plan and submit the revised plan to the *Project Manager* for acceptance.

27.8 SLNT Coordinator

27.8.1 Within twenty (20) Working Days of the *starting date* the *Contractor* shall nominate a member of the *Contractor's* senior personnel (the "SLNT Co-ordinator") with the necessary skills and authority to:

- (a) be responsible for the implementation and on-going development and maintenance of the SLNT Plan; and
- (b) act as the single point of contact with the *Employer's* staff on all matters concerning the SLNT Plan.

27.8.2 The *Employer* has a Supplier Skills Team who may be able to provide guidance to the *Contractor* in relation to SLNT including funding, employability programmes, apprenticeship standards, referral partners and educational institutions.

27.9 Training of Apprentices and Trainees

27.9.1 Within five (5) Working Days of the date of an apprentice's commencement with the *Contractor*, the *Contractor* shall prepare and complete a written training plan for that trainee or apprentice. The training plan shall include:

- (a) details of the skills and competencies to be developed and acquired by the Trainee and/or Apprentice; and
- (b) the timescales by which the Trainee and/or Apprentice should acquire the defined skills and competencies.

27.9.2 The *Contractor* shall:

- (a) review and update training plans for all Trainees and/or Apprentices each month; and
- (b) make copies of completed and up to date training plans available to the *Employer* and *Project Manager* for review at any time.

27.10 Supporting Centres of Excellence

27.10.1 Where appropriate the *Contractor* shall use the nominated centre(s) of excellence for training:

- The Tunnelling Underground and Construction Academy (TUCA)
- The National Training Academy for Rail (NTAR)
- College for High Speed Rail

27.10.2 If the *Contractor* is not intending to use a centre(s) of excellence, they shall indicate in the delivery plan the training provider they intend to use and the reasons.

27.10.3 Employment Vacancies

The *Contractor* shall:

- (a) at the time of placing an advertisement for a Relevant Employment Vacancy, notify the *Employer* (and/or any Third Parties nominated by the *Employer*) and the *Project Manager* of such advertisement and provide details of the:
 - i. Relevant Employment Vacancy;
 - ii. date of the advertisement; and
 - iii. publication in which the advertisement is scheduled to appear or appeared (as applicable); and
- (b) attend a minimum of two (2) events each year, at a time and location specified by the *Employer*, to publicise employment and training opportunities arising from the Contract.

27.11 Monitoring and Reporting

27.11.1 The *Contractor* shall provide the *Employer* and *Project Manager* with a Quarterly SLNT Monitoring Report using the templates in Appendix 27.3. The first submission of the Quarterly SLNT Monitoring Report will be due on thirteen (13) weeks after acceptance (by the *Project Manager*) of the SLNT plan.

27.12 Equality, Diversity and Inclusion (EDI) Action Plan

27.12.1 The *Employers* approach to EDI is founded upon Inclusive London, the Mayor's Equality, Diversity and Inclusion Strategy which can be found at: <https://www.london.gov.uk/sites/default/files/mayors-equality-diversity-inclusion-strategy.pdf>. This sets out his vision for a fairer, more equal, integrated city where all people feel welcome and able to fulfil their potential.

27.12.2 The GLA RPP sets out how the *Employer* will encourage EDI by:

- Removing barriers in procurement approaches and processes that inhibit Small to Medium Enterprises (SMEs), community sector organisations, diverse enterprises and under-represented groups from easily entering the supply chain. The *Employers* procurement processes will be transparent, straightforward, and open to the whole of the supplier community;
- Paying suppliers promptly and paying SME suppliers within ten (10) working days, in recognition of their specific challenge around cash flow, and encouraging our supply chain to adopt supportive practices;
- Reviewing requirements to ensure the goods and services procured support EDI within the *Employers* own workforce and supply chain;
- Identifying opportunities to encourage suppliers to employ a workforce that is representative of the diversity of London's population and provide services that are inclusive;
- Working with organisations (and their supply chains) that have a good track record and can clearly demonstrate promoting EDI within their own organisations; and
- Maximising relevant opportunities to work with voluntary and community sector organisations including social enterprises in supply and service delivery.

27.12.3 Within sixty (60) Working Days of the *starting date*, the *Contractor* shall produce and submit to the *Project Manager* for acceptance an Equality, Diversity and Inclusion (EDI) Action Plan.

27.12.4 The EDI Action Plan shall be specific to the *works* and as a minimum:

- (a) explain the steps that the *Contractor* will take to tackle discrimination, harassment and victimisation on grounds of age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion and belief, sex and sexual orientation;
- (b) outline the recruitment policies and procedures ensure that the *Contractor* does not discriminate or create unequal rates of pay between different protected groups, particularly in relation to disability, ethnicity and gender;
- (c) detail the steps the *Contractor* will take to publicise vacancies to encourage applicants from disadvantaged or underrepresented groups and have measures in place to proactively recruit a diverse workforce including at a senior level;
- (d) demonstrate how the *Contractor* is actively engaging with local employment agencies and local unemployment programmes so that, as vacancies arise in respect of providing the *works*, local people, particularly from groups who are underrepresented in the workforce, are made aware of these opportunities; and

- (e) detail the procedures for creating safe and inclusive workplaces including ways to deal with bullying, harassment and grievances, requests for reasonable adjustments / flexible working and staff assigned to deal with issues of this nature and a robust mechanism for implementation.

27.12.5 The EDI Action Plan shall include the following with respect to training:

- (a) detail which staff are to receive training and what the nature of the particular training will be;
- (b) clear guidance for managers on how to avoid discrimination, harassment and victimisation;
- (c) clear guidance for managers on how to promote EDI within recruitment, training and appraisal;
- (d) appropriate training on delivering inclusive products and services is available to all relevant employees; and
- (e) indicate the types and levels of training, evaluation processes, and how impact will be monitored.

27.12.6 Below is a template for EDI Action Plans, with some example EDI objectives. The *Contractor* shall develop their own format which is relevant to the *works*, but with consideration of the below template.

EDI Objective	Current position/ baseline	Action	Timing	Person responsible	Resources
Recruit and retain a workforce reflective of the local area	From workforce diversity statistics				
Move all staff onto London Living Wage					
Collect and analyses diversity data					
Reduce gender pay gap					
Inclusive recruitment training for hiring managers					
Managing diversity for all line managers/ supervisors					
Inclusive customer service for all public facing staff					

27.12.7 Key policy documents such as an EDI policy should be appended to the EDI Action Plan.

27.12.8 The *Contractor* shall use the below resources in order to help develop their EDI Action Plan.

Mayor's Good Work Standard	https://www.london.gov.uk/what-we-do/business-and-economy/supporting-business/what-mayors-
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	good-work-standard
Equality and Human Rights Commission	https://www.equalityhumanrights.com/sites/default/files/good_equality_practice_for_employers_equality_policies_equality_training_and_monitoring.pdf
Stonewall	https://www.stonewall.org.uk/creating-inclusive-workplaces/best-practice-toolkits-and-resources
Chartered Institute of Personnel and Development	https://www.cipd.co.uk/knowledge/fundamentals/relations/diversity
Inclusive Employers	https://www.inclusiveemployers.co.uk/resources
Business in the Community	https://www.bitc.org.uk/campaigns-programmes/employment-diversity/DiversityInclusion
Employers for Carers	https://www.employersforcarers.org/
Disability Rights UK	https://www.disabilityrightsuk.org/

27.12.9 The *Contractor* shall review and, if necessary, revise the EDI Action Plan annually on the date of the first accepted plan and submit the revised plan to the *Project Manager* for acceptance.

Appendix 27.1 – Strategic Workforce Output Breakdown

To ensure the *Contractor's* SLNT Outputs are aligned to the priorities in the Transport Infrastructure Skills Strategy, a minimum of 50% of SLNT outputs shall be from the Priority SLNT Activity Areas (Table 1).

SLNT activities, definitions and their output value are detailed below in Table 1:

Table 1:

SLNT Output	Definition	SLNT Value	Priority
Apprenticeships			
Apprentice Start New Entrant	A new entrant who is recruited as an apprentice and enrolled on an approved apprenticeship framework or standard. The apprentice must be a UK resident and have not previously completed an apprenticeship.	1 Output Level 2 or 3 apprenticeship start 1.5 Output Level 4 and above apprenticeship start	✓ ✓
Apprentice Start Social Mobility	Apprentice enrolled on an approved apprenticeship framework or standard that can be identified as meeting the definition of improving social mobility.	1 Output 1 output for each Apprenticeship Start 1.5 Output Level 4 and above apprenticeship start	✓ ✓
Apprentice Start Existing Employee	An existing staff member who is enrolled onto an approved apprenticeship framework or standard. The Apprentice must be a UK resident and could be progressing from another apprenticeship, for example from Level 3 to Level 4	1 Output 1 output for each Apprenticeship Start 1.5 Output Level 4 and above apprenticeship start	✓ ✓

Apprentice Success Completion	An existing Apprentice that has completed an approved apprenticeship framework or standard and moved into continuous FTE employment for 90 days or more since completion of apprenticeship.	1 Output 1 output for each successful completion	
Job Creation			
Job Start Social Mobility	A new job start that meets the definition of improving social mobility for that individual.	1 Output 1 output for each Job start	
Educational/Career Support			
Targeted Placement	This includes individuals that can be identified in the definition of improving social mobility, and individuals who are underrepresented in the sector, including women, people with a disability and people from a BAME background. The placement should develop or enhance their knowledge and skills. A placement is expected to last a minimum of 1 week. A placement position could be paid or unpaid .The individual must be a UK resident.	10 days = 1 Output	
Placement Position	A position intended to enable an individual to develop or enhance their knowledge and skills 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 be a UK resident.	20 days = 1 Output	
Educational Engagement	Education activities that support schools, colleges, and Sector Centres of Excellence , by raising awareness of the	20 days = 1 Output	

	educational and employment opportunities in the industry. This could include attending career fairs, visits, taster days, ambassador programmes etc. Institutions supported should be within the UK.		
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When developing the breakdown of the SLNT Outputs the *Contractor* shall be aware of the following definitions and explanations as set out in Table 2.

Table 2:

Priority Activity Areas	SLNT priority activity areas include Apprentice Starts – New Entrant, Social Mobility and Existing Employee
Improving social mobility	<p>Where the individual can be identified in one of the following categories:</p> <ul style="list-style-type: none"> • Resident in one of the 12 most deprived London boroughs • Offender or ex-offender • Homeless • Care leavers • Single parent • Care responsibilities • Refugee status
London Boroughs with highest levels of deprivation	<p>Information sourced from Trust for London. Based on 20 indicators:</p> <p>Poverty rate, child poverty rate, income inequality, pay inequality, homeless acceptances, temp accommodation, landlord repossessions, housing affordability, housing delivery, unemployment ratio, unemployment change, low pay, low pay change, out-of-work benefits, CTS cut, GCSE attainment, qualifications at 19, infant mortality and premature mortality</p> <p>The 12 boroughs with the highest average rank, based on the above indicators are:</p> <ol style="list-style-type: none"> 1. Barking and Dagenham 2. Tower Hamlets 3. Hackney 4. Enfield

	<ol style="list-style-type: none">5. Greenwich6. Newham7. Ealing8. Lewisham9. Haringey10. Brent11. Waltham Forest12. Islington
Sector Centres of Excellence	<p>The Centres of Excellence are purpose built specialist training facilities and include, but not limited to:</p> <ul style="list-style-type: none">• The Tunneling Underground and Construction Academy (TUCA)• National Training Academy for Rail (NTAR)• College for High Speed Rail

Appendix 27.2 – SLNT Activity Breakdown Table

SLNT Activity Breakdown Table										
Organisation										
TfL Contract / Project										
Date										
SLNT Activity Area	Priority Output	Year 1	Year 2	Year 3	Year 4	Year 5	Total	Cross Check		Additional Detail / Information
								SLNT Value	SLNT Totals	
Apprentices (monitoring data to be provided on Sheet 3)										
New Entrant - Level 2-3 (FTE)	Y							1	0	
New Entrant - Level 4+ (FTE)	Y							1.5	0	
Social Mobility - Level 2-3 (FTE)	Y							1	0	
Social Mobility - Level 4+ (FTE)	Y							1.5	0	
Exisiting Employee - Level 2-3 (FTE)	Y							1	0	
Exisiting Employee - Level 4+ (FTE)	Y							1.5	0	
Apprenticeship Success (monitoring data to be provided on Sheet 2)										
Completion (FTE)								1	0	
Job Creation (monitoring data for placements to be provided on Sheet 2)										
Social Mobility (FTE)								1	0	
Job Creation (monitoring data to be provided on Sheet 2)										
Targeted Placement Position (Days)								10	0	
Placement Positions (Days)								20	0	
Educational Engagement (Days)								20	0	
								Total SLNT Activity	0	
								Priority Activities	0	

An excel version can be found in the document titled “Appendix_27.2_SLNT_Activity_Breakdown_Table.xlsx”

Appendix 27.3 – Quarterly Strategic Workforce Monitoring Report

See document titled *“Appendix_27.3_SLNT_Quarterly_Report.xlsx”*

SLNT Activity Table

Organisation	
TfL Contract / Project	
Date	

SLNT Activity Area	Priority Output	Annual Target	Annual Forecast	Outputs this Period	Total Outputs to date	Cross Check		Additional Detail / Information	
						SLNT Value	SLNT Totals		
Apprentices <i>(monitoring data to be provided on Sheet 3)</i>									
New Entrant - Level 2-3 (FTE)	Y					1	0		
New Entrant - Level 4+ (FTE)	Y					1.5	0		
Social Mobility - Level 2-3 (FTE)	Y					1	0		
Social Mobility - Level 4+ (FTE)	Y					1.5	0		
Exisiting Employee - Level 2-3 (FTE)	Y					1	0		
Exisiting Employee - Level 4+ (FTE)	Y					1.5	0		
Apprenticeship Success <i>(monitoring data to be provided on Sheet 2)</i>									
Completion (FTE)						1	0		
Job Creation <i>(monitoring data for placements to be provided on Sheet 2)</i>									
Social Mobility (FTE)						1	0		
Job Creation <i>(monitoring data to be provided on Sheet 2)</i>									
Targeted Placement Position (Days)						10	0		
Placement Positions (Days)						20	0		
Educational Engagement (Days)						20	0		
							Total SLNT Activity	0	
							Priority Activities	0	

Highlights: *Please provide further information on the activities undertaken in this reporting period. This could include a summary of the apprenticeships/job starts delivered, key partners/organisations that you have engaged with, schools/career fairs attended and placements offered.*

--

Issues / Concerns / Risks: *Please highlight any issues that have impacted your SLNT delivery.*

--

Do you Apprentices earn London Living Wage (LLW)? Yes / No

--

Skills Shortage Areas: *Please highlight your top 3 skills shortage areas*

Help & Guidance

SHEET 1: SLNT Reporting Table - Guidance on what is required

Please fully complete the SLNT table, to include forecasted outputs for the year, outputs delivered in the current reporting quarter and total outputs to date for the year. Please ensure that full corresponding monitoring information is provided for all outputs reported in the quarter on Sheet 2 (all outputs excluding apprentices) or Sheet 3 (apprentices). Please use the 'highlights' box below the table to provide further detail on the activities delivered.

What is meant by an apprenticeship?

An apprenticeship combines practical experience in a job with study. Apprentices will work alongside experienced staff and gain job-specific skills. They earn a wage, get holiday pay and in some cases study towards a related qualification. Most apprenticeships take between 1 and 3 years to complete, depending on their level. Some can take longer. Apprentices must be enrolled on and working towards an approved Apprenticeship Standard or Framework. For frameworks, an apprentice will be working towards the selected knowledge and competence qualification/s listed on the framework, and complete their apprenticeship when they have completed the qualifications. For standards, an apprentice will be working towards the competencies set out in the end point assessment, and will complete when they have passed this assessment. It is important to remember that apprenticeships can cover a number of levels, ages and experience – it is not simply about school leavers. Up-skilling existing staff is also important, provided this is carried out using an approved Apprenticeship Standard or Framework.

What is meant by workless?

An individual who is economically inactive is classified as 'workless'. They could be in receipt of benefits but this is not essential. Someone who is in full or part time work or education, or who is moving from education into employment after the summer holidays, would not be classified as workless. As a guide, we would expect an individual to be workless for a minimum of 30 days prior to starting work to be reported as 'workless'.

How will this data be used?

The apprenticeship data on this template will be shared with DfT (Department for Transport). The Unique Identifier code (D.O.B and post code region) is only used to enable DfT to distinguish between unique individuals so that (i) DfT does not duplicate reports from the same source; and (ii) DfT can determine the number of unique individuals. If this ID code is collected together with other information which could identify an individual when combined, DfT remove the UI code to prevent this from occurring. The data contained within this template is used to provide high level statistical analysis and the data is anonymised. DfT will not disclose any information that would allow the individual to be identified.

SHEET 2: SLNT MONITORING FORM - Guidance on what is required for each field

Employer Name
Enter the name of the company the apprentice is employed with.
Supplier Tier in Supply Chain. Select from list
Confirm if the employer is a Tier 1 supplier. If not, select 'other supplier'
SLNT Output Type

Please select from the drop down list the SLNT output type that the individual is being reported as.
Start Date
Please state the start date of the individual.
Job Title
Please state the job title of the individual. If they are completing a placement, please state what role they are shadowing/interested in, or what department they are working in e.g Civil Engineering Placement. For graduates, please state what graduate scheme they are on e.g. Planning Graduate.
Duration
This field only needs to be completed for placement outputs. Please state the duration of the placement e.g. 2 weeks, or 1 day per week for 3 months.
Workless
Confirm if the individual was unemployed prior to starting work. See definition above.
Ethnicity
Select from the drop down list
Gender
Select from the drop down list
Disability
Select from the drop down list
Criminal Conviction
Select from the drop down list
Date of Birth
Input the individual's full date of birth
Home post code (first section only e.g. CB12)
Input the first half of the individual's home post code
Unique identifier (self calculating field) NOTE: Highlighted pink indicates apprentice is duplicated
Nothing needed in this field - populates automatically

SHEET 3: APPRENTICE MONITORING FORM - Guidance on what is required for each field

Employer Name
Enter the name of the company the apprentice is employed with.
Supplier Tier in Supply Chain. Select from list
Confirm if the employer is a Tier 1 supplier. If not, select 'other supplier'
Proposed start date of each apprenticeship
Enter the apprentice enrollment date.
Proposed end date of each apprenticeship
Enter the expected apprenticeship completion date.
Apprenticeship Standard - select from following link https://www.gov.uk/government/collections/apprenticeship-standards
If the apprentice is enrolled on an apprenticeship standard, use the link https://www.gov.uk/government/collections/apprenticeship-standards to select the relevant approved standard that the apprentice is working towards and include the full apprenticeship title.
Apprenticeship Framework - select from following link http://www.afo.sscalliance.org/frameworks-library/
If the apprentice is enrolled on an apprenticeship framework, use the link http://www.afo.sscalliance.org/frameworks-library/ to select the relevant approved framework that the apprentice is working towards and include the full apprenticeship title including the pathway title.
Level of apprenticeship. Select from list
Select the level of the apprenticeship from the drop down list. Equivalence qualifications have been listed as examples.

Level 2 - (equivalent to GCSE [A* to C], NVQ level 2)
Level 3 - (equivalent to AS and A level NVQ level 3)
Level 4 - (equivalent to Certificate of Higher Education, NVQ level 4)
Level 5 - (equivalent to Higher National Diploma, NVQ level 4)
Level 6 - (equivalent to Bachelors Degree)
Level 7 - (equivalent to Postgraduate Diploma, Master's Degree)
Level 8 - (equivalent to PhD)
Occupation of apprenticeship (SOC code). Select from list
Select the most relevant job title/role from the drop down list. If your apprentice occupation is a back office support function or not listed then select none of the above.
Workless
Confirm if the apprentice was unemployed prior to starting their apprenticeship. See definition above
Ethnicity
Select the apprentice's ethnicity from the list, or select 'prefer not to say'.
Gender
Select from the drop down list
Disability
Select from the drop down list
Criminal Conviction
Select from the drop down list
Date of Birth of apprentice
Input the apprentice's full date of birth
Home post code of apprentice (first section only e.g. CB12)
Input the first half of the apprentice's home post code
Completed? Select from list
This selection is to measure the number of completed apprenticeships and is used for supplier monitoring and reporting
Unique identifier (self calculating field) NOTE: Highlighted pink indicates apprentice is duplicated
This field identifies if there are any duplicate entries when information is collated by TfL and the DfT.

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 28

Accounts and Records

Table of Contents

28.1	General	1
28.2	Glossary	1
28.3	Records to be kept by the <i>Contractor</i>	2
28.4	Audit Rights	3
28.5	Conduct of Audits	5
Appendix 28.1	Not Used	6

28.1 General

28.1.1 This section further defines the specific requirements with regards to:

- the minimum generic requirements for records, reviews and audits relating to the *works*;
- management and performance tasks that are required to be carried out by the *Contractor* in order to efficiently Provide the Works; and
- describe the deliverables that the *Contractor* shall submit to the *Project Manager* for acceptance and those that the *Contractor* shall submit to the *Project Manager* which are subject to review or audit in accordance with the Works Information.

28.2 Glossary

Term	Definition
Comptroller and Auditor General	is the government official from the National Audit Office who is responsible for supervising the quality of public accounting and financial reporting.
Cyber Security Management Plan	means the <i>Contractor's</i> cyber security plan developed and revised pursuant to the requirements.
Technical Information	means information and materials required by the <i>Employer</i> in order to operate the OPO CCTV System and the installation of OTC Infrastructure Borne Equipment and Stopping Markers and shall include: <ul style="list-style-type: none"> (a) all calculations, analyses, information and interface information, drawings, records (including design, manufacture, installation, test, commissioning, maintenance and operational records) and data and Documentation; (b) all safety cases, assurance information, approvals (including restrictions on use), hazard and safety risk logs, verification and validation records; (c) the operating and maintenance manuals; and (d) all training materials.
National Audit Act 1983	means the National Audit Act 1983 Chapter 44
National Audit Office	means The National Audit Office whose registered office is 157-197 Buckingham Palace Road, London, SW1W 9SP
Strategic Labour Needs Training (SLNT) Plan	a plan provided by the <i>Contractor</i> which outlines the SLNT outputs it will use in order to meet the Employers SLNT requirements.
VAT	Value Added Tax

28.3 Records to be kept by the *Contractor*

28.3.1 The records to be kept by the *Contractor*, (but are not limited to) are:

- The Implementation Works Terms, and all accompanying schedules and sections including all amendments to such documents.
- All other documents which the Contract or these Implementation Works Terms expressly require to be prepared.
- Records relating to the appointment and succession of each member of the Key People.
- All manuals and other Technical Information prepared by the *Contractor* for the purpose of operating or maintaining the OPO CCTV System.
- Documents prepared by the *Contractor* or received by the *Contractor* from a third party relating to a prevention event.
- All formal notices, reports or submissions made by the *Contractor* to the *Project Manager* in connection with the provision of the *works*.
- All consents, approvals, certificates, licences, registrations or warranties in each case obtained by the *Contractor* in relation to the provision of the *works*.
- Documents prepared by the *Contractor* in support of claims for Defined Cost.
- Documents submitted by the *Contractor* pursuant to the Dispute Resolution Procedure.
- Documents evidencing any change in ownership or any interest in any or all of the shares in either the *Contractor* or its ultimate parent company, or both, where such change may cause a Change of Control; and including documents detailing the identity of the persons changing such ownership or interest.
- Invoices and records related to VAT sought to be recovered by the *Contractor*.
- Financial records, including audited and un-audited accounts of the *Contractor's* ultimate parent company and the *Contractor*.
- Records required to be retained by the *Contractor* by law, including in relation to health, safety and environmental matters and health and safety files and all consents.
- All documents relating to insurances to be maintained and any claims made in respect of them.
- All journals and audit trail data referred to in the Cyber Security Management Plan.
- All records relating to the Strategic Labour Needs Training (SLNT) Plan and its compliance with the provisions of Responsible Procurement and sustainable delivery

- All other records, notices or certificates required to be produced or maintained by the *Contractor* pursuant to the Implementation Works Terms.

28.4 Audit Rights

28.4.1 The *Employer* and the *Project Manager*, acting by itself or through its appointment of Audit Agents, shall have the right during the *works* and for a period of twelve (12) years from Completion, to assess compliance by the *Contractor* and its Subcontractors (of any tier) of the *Contractor's* obligations under these Implementation Works Terms, including, but not limited to, any one (1) or more of the following:

- to verify the integrity and content of any element of Defined Cost;
- to verify the accuracy of Defined Cost and any other amounts payable by the *Employer*;
- to verify Defined Cost and any other costs (including the amounts paid to all Subcontractors and any third party contractors);
- to verify the open book data;
- to verify the *Contractor's* and each Subcontractor's compliance with the Implementation Works Terms and applicable law;
- to identify or investigate actual or suspected fraud, impropriety or accounting mistakes or any breach or threatened breach of security and in these circumstances the *Employer* shall have no obligation to inform the *Contractor* of the purpose or objective of its investigations;
- to identify or investigate any circumstances which may impact upon the financial stability of any one or more of the *Contractor*, its ultimate parent company or any Subcontractors or their ability to Provide the Works;
- to obtain such information as is necessary to fulfil the *Employer's* obligations to supply information for parliamentary, ministerial, judicial or administrative purposes including the supply of information to the Comptroller and Auditor General;
- to review any books of account and the internal contract management accounts kept by the *Contractor* in connection with the *works*;
- to carry out the *Employer's* internal and statutory audits and to prepare, examine or certify the *Employer's* annual and interim reports and accounts;
- to enable the National Audit Office to carry out an examination pursuant to Section 7ZA of the National Audit Act 1983 of the economy, efficiency and effectiveness with which the *Employer* has used its resources;
- to verify the accuracy and completeness of any management information delivered or required by the Works Information;
- to review any performance monitoring reports or other records relating to the *Contractor's* performance of the *works* and to verify that these reflect the *Contractor's* own internal reports, records and accounts;
- to inspect the IT environment (or any part of it) and the wider service delivery environment (or any part of it);

- to review the accuracy and completeness of the registers;
- to review any records created during the design and development of the OPO CCTV System and pre-operational environment such as information relating to testing and the *Contractor's* compliance with any design requirements, including pursuant to the Works Information;
- to review the *Contractor's* quality management systems (including all relevant quality plans and any quality manuals and procedures);
- to review the *Contractor's* compliance with the relevant TfL Standards, British Standards and European Standards;
- to inspect the *Employer's* assets, equipment and facilities, for the purposes of ensuring that the *Employer's* assets are secure and that any register of assets is up to date;
- to review the integrity, confidentiality and security of the *Employers* data;
- to review the *Contractor's* compliance with the provisions for Responsible Procurement and Work Related Road Risk;
- to review the *Contractor's* compliance in relation to cyber security;
- to review the *Contractor's* compliance with any health and safety related requirements;
- to review the *Contractor's* compliance with criminal records declarations (inclusive); and or
- to test the *works* and ascertain the conformance of the *works* with the Implementation Works Terms.

28.4.2 Except where an audit is imposed on the *Employer* by a regulatory body or where the *Employer* has reasonable grounds for believing that the *Contractor* has not complied with its obligations under the Implementation Works Terms, the *Employer* may not conduct an audit, of the same type, of the *Contractor* or of the same Subcontractor more than twice in any Financial Year.

28.4.3 Nothing in the Contract shall prevent or restrict the rights of the Comptroller and Auditor General or their representatives from carrying out an audit, examination or investigation of either or both the *Contractor* or any of their Subcontractors for the purposes of and pursuant to applicable law.

28.4.4 Any audit, inspection or testing by the *Employer* pursuant to the Works Information shall not relieve the *Contractor* (or any of its Subcontractors) from any obligation under the Implementation Works Terms or prejudice any of the *Employer's* rights, powers or remedies against the *Contractor*.

28.5 Conduct of Audits

28.5.1 The *Project Manager* shall, during each audit, comply with those security, sites, systems and facilities operating procedures of the *Contractor* that the *Employer* deems reasonable and use its reasonable endeavours to ensure that the conduct of each audit does not unreasonably disrupt the *Contractor* or delay Providing the Works.

28.5.2 Subject to the *Employer's* obligations of confidentiality, the *Contractor* shall on demand provide the *Employer* and the Audit Agents with all reasonable co-operation and assistance (and shall procure such co-operation and assistance from its Subcontractors) in relation to each audit, including:

- all information and records requested by the *Employer* within the permitted scope of the audit including computer stored data and systems;
- reasonable access to any *Contractor's* premises and procuring reasonable access to the premises of Others and to any equipment used (whether exclusively or non-exclusively) in the performance of the works; and
- access to *Contractor's* Personnel.

28.5.3 The *Contractor* shall implement all measurement and monitoring tools and procedures necessary to measure and report on the *Contractor's* performance of the works against the applicable performance indicators and key performance indicators at a level of detail sufficient to verify compliance with the performance indicators and key performance indicators.

28.5.4 The *Employer* shall endeavour to (but is not obliged to) provide at least fifteen (15) Working Days' notice of its intention to conduct an audit.

28.5.5 Response to Audits

If an audit undertaken identifies that:

- the *Contractor* has committed a default, the *Employer* may (without prejudice to any rights and remedies the *Employer* may have), require the *Contractor* to correct such default as soon as reasonably practicable;
- there is an error in an application for payment or any financial record provided to the *Employer*, the *Contractor* shall promptly rectify the error;
- the *Employer* has overpaid any Defined Cost, the *Contractor* shall pay to the *Employer* the amount overpaid and the *Employer* may exercise its right to deduct such amount from Defined Cost if it prefers; and
- the *Employer* has underpaid any Defined Cost, the *Employer* shall pay to the *Contractor* the difference between the amount that was due and the amount that was paid.

Appendix 28.1

Not Used

Deep Tube Upgrade Programme

OPO CCTV System

Common Works Information

CWI 29

Standards and Guidance

Table of Contents

29.1	General	2
29.2	Glossary	2
29.3	List of TfL Standards and Rule Books	2
29.4	List of TfL Procedure Documents	4
29.5	List of TfL Guidance, Leaflets and Other Documents	5
29.6	List of Other Standards	6
Appendix 29.1 – Not Used		9

29.1 General

This section further defines TfL Standards, TfL Guidance Documents, TfL Procedure Documents and Other Standards that the *Contractor* shall comply with in the delivery of the *works*.

29.2 Glossary

Term	Definition
Rule Book	Procedure documents that govern the principles to running of the operational railway.
TfL Procedure Document	A document provided by the <i>Employer</i> which specifies or describes how a process, or part of a process, is to be performed.
TfL Guidance Document	A document provided by the <i>Employer</i> which provides direction on how a process, or part of a process, is to be performed.
Other Standards	An established norm or requirement published by an international, European or British Standards organisation, or an established norm or requirement published by or on behalf of the Employer or Network Rail (RGS).

29.3 List of TfL Standards and Rule Books

Reference	Title	Version
1-106	Earthing And Bonding Of LU Electrical Networks	A1
1-144	Wireless Communication Systems	A1
1-212	Production Of A Reliability Case	A1
1-382	Train Decor Design (Decor)	A6
1-416	Competence For Possession Master (Train Movement)	A1
1-417	Competence For Possession Master	A1
1-418	Competence For Train Master	A2
1-420	Competence For Protection Master (Traffic Hours)	A1
1-506	Requirements For Developing An LU Access Briefing	A2
S1026	Topographical surveys and mapping	A3

Reference	Title	Version
S1027	Site hoarding, fencing and barriers	A3
S1035	Location Coding System	A4
S1037	Computer Aided Design Data	A3
S1041	Provision Of Engineering Asset Information	A3
S1043	Obsolescence Management	A1
S1063	Cutting, grinding, drilling, fixing to and supporting from existing structures	A5
S1066	Lighting of London Underground Assets	A5
S1069	Low Voltage Electrical Installations	A5
S1085	Fire Safety Performance of Materials - Stations and Tunnel Infrastructure	A4
S1088	Managing changes to stations and shafts fire precautions	A2
S1130	Control of Asbestos in London Underground Premises	A5
S1131	Premises - station platforms	A6
S1140	Telecommunications philosophy and principles	A2
S1147	Surveillance & Security Systems	A1
S1156	Gauging and Clearances	A10
S1193	Electromagnetic Compatibility (EMC) With LU Signalling System Assets	A4
S1217	Integration of Human Factors into Systems Development	A2
S1222	Electromagnetic compatibility	A3
S1251	Alcohol and Work	A2
S1257	Drugs and Work	A2
S1371	Station Planning	A6
S1419	Competence for Protection Master (Engineering Hours) Protecting Workers on the Track (Engineering Hours)	A2
S1472	Allocation Of Space On Operational Property	A2
S1483	High visibility clothing for going on or near the track	A3

Reference	Title	Version
S1538	Assurance	A14
S1552	Contract Quench Conditions	A18
S1741	Cloud cyber security	A2
S1744	Operational Technology Cyber Security	A1
S1748	Wireless network and communications security	A1
S1749	Secure Software, application and web development	A1
S1760	Standard Method and Procedure (SMP) and Common Data Environment (CDE)	A2
S1782	IRM TfL Standard - Information Security Classification	A1
RuleBook13	LU Staff Responsibilities - Traffic Hours Protection	A3
RuleBook14	Possessions Planning And Management	A3
RuleBook15	Protection Possession Methods	A3
RuleBook16	Going On The Track In Engineering Hours	A3
RuleBook17	Managing Access To The Track In Engineering Hours	A3
RuleBook18	Engineer's trains, vehicles and trolleys	A3
RuleBook20	Engineering Staff - Traffic Hours Protection	A3
RuleBook21	Personal Safety On The Track	A3
RuleBook22	LU Operational Staff Track Access	A3
RuleBook23	Incompatible train operations	A2

29.4 List of TfL Procedure Documents

Reference	Title	Version
PR0630	Fire Detection Isolations, Smoke to Heat Detector Substitutions	A2

29.5 List of TfL Guidance, Leaflets and Other Documents

Reference	Title	Version
G0130	Asbestos Control & Management	A4
G1233	Movement of materials in lifts and escalators	A4
G1323	Noise and vibration asset design	A3
G-150	Telecommunications - OPO CCTV Systems	A1
G222	"Guidance on electromagnetic compatibility"	A3
Interface Plan	DTUP Interface Management Plan	Issue 5
LF14	Applying for a storage licence	Issue 5
RAM Plan	DTUP RAM Management Plan	Issue 4
S1331	London Underground Signs Manual	Issue 4
Safety Management Plan	DTUP Engineering Safety Management Plan	Rev 4
V&V Plan	DTUP Verification and Validation Plan	Issue 3

29.6 List of Other Standards

Reference	Title	Version
2004/108/EC	The approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.	N/A
2014/30/EU	The harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast).	N/A
BS 5760	Reliability of systems, equipment and components.	N/A
BS 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems	2010
BS 6701	Telecommunications equipment and telecommunications cabling – Specification for installation, operation and maintenance	2017
BS 6853	Code of Practice for Fire Precautions in the Design and Construction of Passenger Carrying Trains	1999
BS 7430	Code of practice for protective earthing of electrical installations	2011+A1 :2015
BS 7671	Requirements for Electrical Installations. IET Wiring Regulations	2018
BS AU 148-15	Methods of test for motor vehicle paints - Part 15: Resistance to chipping	1969
BS EN 45545-2	Railway Applications. Fire Protection on Railway Vehicles. Requirements for Fire Behaviour of Materials and Components	2013
BS EN 50121-3-2	Railway Applications. Electromagnetic Compatibility. Rolling Stock. Apparatus	2016
BS EN 50121-4	Railway applications. Electromagnetic compatibility. Emission and immunity of the signalling and telecommunications apparatus	2016
BS EN 50124-1	Railway Applications. Insulation Coordination. Basic Requirements. Clearances and Creepage Distances for all Electrical and Electronic Equipment.	2001+A2 :2005
BS EN 50124-2	Railway applications. Insulation coordination. Part 2: Overvoltages and related protection.	2001 (Incorporating corrigendum May 2010)
BS EN 50125-1	Railway Applications. Environmental Conditions for Equipment - Part 1: Rolling Stock and On-Board Equipment	2014
BS EN 50125-3	Railway applications. Environmental conditions for equipment. Equipment for signalling and telecommunications.	2003

Reference	Title	Version
BS EN 50126	Railway Applications -The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)	2017
BS EN 50128	Railway applications - Communication, signalling and processing systems	2011
BS EN 50129	Railway applications - Communication, signalling and processing systems	2018
BS EN 50153	Railway applications. Rolling stock. Protective provisions relating to electrical hazards	2014
BS EN 50155	Railway Applications. Electronic Equipment Used on Rolling Stock	2007
BS EN 50174-Part 1	Information technology – Cabling installation	2018
BS EN 50174-Part 2	Information technology – Cabling installation	2018
BS EN 50174-Part 3	Information technology – Cabling installation	2018
BS EN 50264	Railway Applications. Railway Rolling Stock Power and Control Cables having special Fire Performance	2008
BS EN 50306	Railway Applications. Railway Rolling Stock Cables having special Fire Performance	2002
BS EN 50382	Railway Applications. Railway Rolling Stock High Temperature Power Cables having special Fire Performance	2008+A1 2013
BS EN 60077	Railway applications. Electric equipment for rolling stock. All parts.	2017 and 2003 for parts 4 & 5
BS EN 60529	Degrees of Protection Provided by Enclosures (IP code)	1992+A2 2013
BS EN 61373	Railway Applications. Rolling Stock Equipment. Shock and Vibration Tests.	2010
BS EN 61643-11	Low-voltage surge protective devices. Surge protective devices connected to low-voltage power systems. Requirements and test methods	2012+A1 1:2018
BS EN 61935-Part 1	Specification for the testing of balanced and coaxial information technology cabling	2009
BS EN 61935-Part 2	Specification for the testing of balanced and coaxial information technology cabling	2010
BS EN 62305-1	Protection against lightning	2011
BS EN 62491	Industrial systems, installations and equipment and industrial products — Labelling of cables and cores	2008
BS EN ISO 19011	Guidelines for auditing management systems	2018
BS EN ISO 9001	Quality management systems. Requirements	2015

Reference	Title	Version
BS EN ISO 9227	Corrosion tests in artificial atmospheres - Salt spray tests	2012
BS OHSAS 18001	Occupational Health and Safety Management	2007
BS ISO 7010	Graphical Symbols - Safety Colours and Safety Signs - Registered Safety Signs	2011
BS ISO/IEC 15288	Systems Engineering — System Life Cycle Processes.	2015
Directive 2014/53/EU	Radio Equipment Directive (RED)	N/A
HSG65	Managing for Health and Safety	2013
IEC 60793-2	Fibre Optic Cables	2017
IEEE 802.11	Wireless Ethernet LAN	N/A
IEEE 802.3	Wired Ethernet LAN	N/A
ISO 10005	Quality management - Guidelines for quality plans	2018
ISO 45001	Occupational Health and Safety	2018
ITU-R BT 500-13	Methodology for the subjective assessment of the quality of television pictures	01/2012
LFEPA Fire Safety Guidance Note 29	Access for Fire Appliances	2007
The Radio Equipment Regulations 2017	The Radio Equipment Regulations 2017	N/A
TIA/EIA-564 series	Structured Cabling	N/A
UK SI 2006 No. 3418	The Electromagnetic Compatibility Regulations 2006	N/A

Appendix 29.1

Not Used