

Schedule 5(k)

Closed-Circuit Television (CCTV)

California High-Speed Rail Authority



Standard Specifications

TSCC Specifications

SPEC-0015 – Closed-Circuit Television (CCTV)

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1 INTRODUCTION

1.1 Scope of the Technical Specification

- 1.1.1 The scope of this Technical Specification is to define the Authority's Requirements for the Closed-Circuit Television (CCTV) system, hereinafter: CCTV.
- 1.1.2 This Technical Specification is based on the Authority's Design Criteria Manual (DCM) Chapter 12: Communication Systems and Train Control.
- 1.1.3 The functional architecture of the CCTV System alongside is presented in Appendix A.
- 1.1.4 The requirements are formulated using the following words and their meanings:
 - **"Shall"**: Indicates a mandatory requirement that must be strictly implemented; a waiver from a mandatory requirement is permissible only with approval of a design variance.
 - **"Should"**: Indicates a preferred course of action; a design variance is not required if it is not exercised.
 - **"Must"**: Indicates an obligation or a mandatory requirement.
 - **"May"**: Indicates a permissible course of action within the limits of the standards; a design variance is not required if it is not exercised.



2 REFERENCE STANDARDS AND DOCUMENTS

2.1 General

- 2.1.1 The TSCC Contractor shall apply the in-force standards, guidelines, and specifications provided in this chapter for all stages of the design, test, manufacture, supply, delivery, assembly, installation, testing, commissioning, and training.

2.2 Design Guidelines

- 2.2.1 The latest version of the following Design Guidelines shall be applied:

ID	Code	Title
[R1]	Design Criteria Manual	Chapter 5 – Safety and Security
[R2]	Design Criteria Manual	Chapter 12 – Communication Systems and Train Control
[R3]	AREMA Standards	Chapter 17 – High-Speed Rail Systems

TABLE 30 DESIGN GUIDELINES

2.3 TSI

- 2.3.1 Not applicable for the CCTV system.

2.4 Standards

- 2.4.1 The TSCC Contractor shall fully consider and apply the following standards, the in-force standards shall be applied.

ID	Code	Title
[R4]	EN 50121	Railway Applications – Electromagnetic Compatibility
[R5]	EN 50122-1	Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock
[R6]	EN 50124	Railway applications - Insulation coordination
[R7]	EN 50125	Railway applications - Environmental conditions for equipment
[R8]	EN 50126-1	Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process
[R9]	EN 50126-2	Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety
[R10]	EN 50128	Railway applications - Communication, signaling and processing systems - Software for railway control and protection systems
[R11]	EN 50159	Railway applications - Communication, signaling and processing systems - Safety-related communication in transmission systems
[R12]	EN 50164	Lightning Protection Components



ID	Code	Title
[R13]	EN 50173	Information technology - Generic cabling systems
[R14]	EN 50174	Information technology - Cabling installation
[R15]	EN 50289-1-6	Communication cables - Specifications for test methods - Part 1-6: electrical test methods - Electromagnetic performance
[R16]	EN 50310	Application of equipotential bonding and earthing in buildings with information technology equipment
[R17]	EN 55024	Information technology equipment. Immunity characteristics. Limits and methods of measurement
[R18]	EN 60065	Audio, video and similar electronic apparatus - Safety requirements
[R19]	EN 60297-3	Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series - Part 3-100: basic dimensions of front panels, sub racks, chassis, racks and cabinets
[R20]	EN 60664-1	Insulation coordination for equipment within low-voltage systems -- Part 1: Principles, requirements and tests
[R21]	EN 61000-6	Electromagnetic compatibility (EMC) - generic standards
[R22]	EN 61034	Measurement of smoke density of cables burning under defined conditions
[R23]	EN 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
[R24]	EN 62305	Protection against lightning
[R25]	EN 62676	Video surveillance systems for use in security applications
[R26]	IEC 60068	Environmental testing
[R27]	IEC 60331	Tests for electric cables under fire conditions
[R28]	IEC 60364	Low-voltage electrical installations (equivalent to HD 384 series)
[R29]	IEC 60529	Degrees of protection provided by enclosures (IP Code)
[R30]	IEC 61000-3-6	Electromagnetic compatibility (EMC) - Part 3: Limits - Section 6: Assessment of emission limits for distorting loads in MV and HV power systems - Basic EMC publication
[R31]	IEC 61000-3-7	Electromagnetic compatibility (EMC) - Part 3-7: Limits - Assessment of emission limits for the connection of fluctuating installations to MV, HV and EHV power systems
[R32]	IEC 61000-5-2	Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling
[R33]	IEC 61643	Low-voltage surge protective devices
[R34]	IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
[R35]	ISO 9001	Quality management systems — Requirements
[R36]	ISO 11064	Ergonomic design of control centers



ID	Code	Title
[R37]	ISO/CEI 15288	Systems engineering - Systems life cycle processes
[R38]	IEEE 1220	IEEE Standard for Application and Management of the Systems Engineering Process
[R39]	IEEE 60068-2-1	Environmental testing - Part 2-1: Tests - Test A: Cold
[R40]	IEEE 60068-2-30	Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
[R41]	NFPA 780	Standard for the Installation of Lightning Protection Systems
[R42]	APTA IT-CCTV-RP-001-11	Selection of Cameras, Digital Recording Systems, Digital High-Speed Networks, and Trainlines for Use in Transit-Related CCTV Systems

TABLE 31 LIST OF APPLICABLE STANDARDS

2.5 Other Documents

2.5.1 The following documents shall be referred to:

ID	Document	Title
[R43]	Schedule 16	Scope of Work
[R44]	Schedule 5(a) SPEC-0005	Cybersecurity Specification
[R45]	Schedule 1	Safety, Security and RAM Requirements

TABLE 32 OTHER DOCUMENTS

3 TERMS, DEFINITIONS, AND ABBREVIATIONS

- 3.1.1 All the terms, definitions, and abbreviations are provided in: Glossary of Terms, Abbreviations and Definitions.



4 SYSTEM DESCRIPTION

4.1 Purpose of the CCTV System

- 4.1.1 The purpose of the CCTV System is to ensure the achievement of the objectives of security management, including prevention of crime and disorder, protection of passengers and personnel in railroad stations, and protection of the California High-Speed-Rail Assets, including technical equipment installed inside the facilities.
- 4.1.2 Main objectives of CCTV System include, but are not limited to deterrence, prevention, real-time security supervision, supervision of the station and railway operations, investigation of events and violations.

4.2 CCTV System Definition

- 4.2.1 CCTV System is a closed system consisting of CCTV cameras, wired data networks, and Video Management System that enables reliable monitoring of the California High-Speed-Rail railway infrastructure environment from dedicated locations.
- 4.2.2 CCTV System main components include:
- Camera- IP cameras of types such as dome, dome panoramic, bullet, box, and Pan, Tilt, and Zoom (PTZ) cameras.
 - Network Video Recorder (NVR)- server-based NVRs installed at OCC, Depot, and Stations.
 - Video Management System (VMS)- provides centralized management of all devices and servers. It includes management servers installed at OCC.
 - Video Analytics System (VAS)- Seamlessly integrated with the VMS that enhances surveillance by leveraging advanced software and Artificial Intelligence to analyze video feeds in real time or post-event.

4.3 CCTV System Operational Context

- 4.3.1 The mission of the CCTV System is to support the California High-Speed-Rail infrastructure security by providing real-time and historic video coverage, safety and security related alarms for OCC building, stations, depot, maintenance facilities, train care facilities, traction power facilities, strategic locations (tunnels, bridges, etc.) and wayside facilities along the California High-Speed Rail Right-of-Way.

4.4 Design Life

- 4.4.1 The design life of CCTV system shall be 30 years.
- 4.4.2 The design life requirements of the CCTV system shall allow for the pertinent evolution and technological change of the CCTV system throughout its life to ensure it remains fit for purpose.
- 4.4.3 The TSCC Contractor shall ensure that CCTV system components with shorter design lifespans shall be managed by scheduled technology refresh strategies and spares management plans.
- 4.4.4 The TSCC Contractor shall ensure that the manufacturers will be able to produce CCTV system components (with equal or compatible technical specifications) for the entire design life required.



5 SYSTEM REQUIREMENTS

5.1 General Requirements

5.1.1 CCTV System

- 5.1.1.1 The TSCC Contractor shall be responsible for all components, systems, interfaces, and activities necessary to fully design, deliver, integrate, test, and operationalize the CCTV system to the standard required for high-speed rail operations and for CHSR to enter revenue service. This includes, but is not limited to, design, procurement, sourcing, construction, installation, configuration, integration, verification, validation, training, documentation, operations, maintenance, and handover of all CCTV subsystems, in accordance with the requirements of this and other specifications, and subject to acceptance by the Authority.
- 5.1.1.2 The TSCC Contractor shall provide all necessary CCTV equipment, cabling, software, and licenses.
- 5.1.1.3 The CCTV system shall be end-to-end IP (Internet Protocol) based.
- 5.1.1.4 The CCTV system shall provide supervision at OCC building, stations, depot, maintenance facilities, train care facilities, traction power, strategic locations (tunnels, bridges, etc.), and wayside facilities along the California high-speed right-of-way, and they shall be connected through the Digital Communication Network (DCN).
- 5.1.1.5 The CCTV system monitoring and control shall be provided from the ICSS (Integrated Control and Supervision System) workstation. It shall be possible to provide a comprehensive overview of all supervised locations.
- 5.1.1.6 The local CCTV system at stations shall be controllable by the OCC. The TSCC Contractor's CCTV design shall also accommodate future control of the CCTV system from the stations.
- 5.1.1.7 In the event of a major incident, recording media from all camera systems may be required for evidence. It is essential that operators ensure that the recording systems of any CCTV system are protected in this way, and that backup or spare recording media are also provided to allow the systems to continue to be used when major incidents occur. Major incidents need not be limited to terrorist events and may well be linked to environmental or criminal acts. Recording systems shall provide for a minimum of 30 days storage.
- 5.1.1.8 A redundant recording architecture and high availability mechanisms shall be implemented on the CCTV system's recording equipment/resources of the architecture to protect the recording capacity against hardware or software single point of failure.
- 5.1.1.9 The servers of the CCTV system must be provided with the appropriate number of licenses for the number of CCTV cameras designed for across HSR infrastructure.
- 5.1.1.10 Application of different types of CCTV cameras and camera parameters (i.e., optimal CCTV camera location, coverage, orientation, resolution, etc.) shall be precisely defined by the TSCC Contractor when CCTV Equipment Layout and Coverage Study for each location is executed.
- 5.1.1.11 The CCTV cameras shall be installed at locations and according to conditions defined in the CCTV Equipment Layout and Coverage Study for each specific location.
- 5.1.1.12 The TSCC Contractor shall develop a CCTV thermal imaging study to determine the justification for the use of thermal imaging cameras.
- 5.1.1.13 The CCTV cameras on the perimeter shall be installed in such a way that there is no blind spot and the camera is also in the field of view of another camera.



- 5.1.1.14 The CCTV system shall be able to integrate fixed CCTV and PTZ cameras.
- 5.1.1.15 The CCTV system shall allow controlling the Pan, Tilt, and Zoom functions of the PTZ cameras, including user-controlled movement, predefined tour paths, position presets, and event-driven PTZ positioning.
- 5.1.1.16 All CCTV cameras shall receive power through active equipment such as Power over Ethernet (PoE) switches.
- 5.1.1.17 For PTZ cameras requiring a separate power source, the TSCC Contractor shall provide a suitable power source that supplies either 110-120V AC at 60Hz, or alternatively, 12V DC or 24V at 60Hz.
- 5.1.1.18 For CCTV cameras further away from the PoE switches (>90m), PoE extensions shall be used or an optical cable with a CAT6a cable transition.
- 5.1.1.19 The indoor and outdoor CCTV cameras shall be used depending on the installation environment.
- 5.1.1.20 The provision of CCTV coverage within non-public indoor areas shall consider the appropriateness and necessity of surveillance. Camera locations in such areas shall be proposed by the TSCC Contractor and subject to review and approval by the Authority to ensure a balance between security needs and staff privacy.
- 5.1.1.21 The day/night CCTV cameras shall be used for surveillance in poorly lit areas and in areas that require surveillance during the night.
- 5.1.1.22 The CCTV camera must possess the capability to autonomously store video recordings locally in the event of a loss of connection between the CCTV camera and the NVR.
- 5.1.1.23 Upon the restoration of connection with the NVR, the CCTV system is required to initiate an automatic upload of locally stored video footage to the NVR.
- 5.1.1.24 Tamper-evident solution shall be provided for the local storage (memory driver) of the CCTV camera.
- 5.1.1.25 The installation of a communication network in the facilities shall be implemented using halogen-free cable (e.g., S/UTP cat 6.A), and outside the facilities by using (e.g., S/FTP cat 6.A) cables for outdoor installation.
- 5.1.1.26 The CCTV equipment shall be compatible with CHSR branding, visual identity, signage system, and graphical charts, and shall be fully integrated in the overall station designs and shall take architectural constraints into account.
- 5.1.1.27 The CCTV equipment shall respect and adapt to the architectural designs of stations and other facilities to avoid visual impacts on the constructive elements of the different facilities and shall fit and be installed harmoniously.
- 5.1.1.28 The VMS primary and backup central servers shall be installed in OCC.
- 5.1.1.29 The primary and backup central recording of the NVR system shall be installed in OCC.
- 5.1.1.30 Local NVRs in stations shall be installed in the dedicated CCTV distribution cabinet.
- 5.1.1.31 Backup of local recordings shall be provided by the primary/backup central recording in OCC.
- 5.1.1.32 The OCC building and depot outdoor perimeter shall be equipped with dome and PTZ cameras. The technical premises in OCC, where the central equipment of the CHSR system is located, shall also be equipped with dome cameras.
- 5.1.1.33 Types of CCTV cameras to be installed in stations should include, but not be limited to dome, dome panoramic, bullet, box, and PTZ cameras.



- 5.1.1.34 Inside the technical building (or container), cabling shall be done using halogen-free cables that are pulled through halogen-free pipes (in the wall, fixed in a suspended ceiling, raised floor), or laid in cable trays in the suspended ceiling voids/raised floors/cable channels or in a floor distribution system.

5.1.2 CCTV Camaras

- 5.1.2.1 The CCTV camera's resolution shall be at least 4K or the highest commercially available resolution.
- 5.1.2.2 The TSCC Contractor shall carry out a value engineering exercise to investigate the viability of using 4MP (2560 x 1440 pixels) cameras.
- 5.1.2.3 The CCTV cameras' frame rate shall be at least 25 frames per second.
- 5.1.2.4 The CCTV cameras shall have a True Wide Dynamic Range (120dB WDR).
- 5.1.2.5 The CCTV cameras shall have at least a minimum lux rating for color images of 0.0005 lux.
- 5.1.2.6 The CCTV cameras shall have at least a minimum lux rating for black and white images of 0.0001 lux.
- 5.1.2.7 All cameras shall have image stabilization.
- 5.1.2.8 PTZ cameras shall be capable of auto-tracking.
- 5.1.2.9 The PTZ camera shall be capable of panning, tilting and zooming simultaneously.
- 5.1.2.10 The PTZ cameras shall have the capability of setting and recalling pre-set positions.
- 5.1.2.11 PTZ speed shall be configurable.
- 5.1.2.12 The PTZ shall return to home after a configurable period of inactivity.
- 5.1.2.13 The PTZ cameras shall be capable of achieving the inspection or strong identification pixel density for the area they are covering.
- 5.1.2.14 The PTZ camera shall support common protocols for seamless integration and control, such as ONVIF (Open Network Video Interface Forum).
- 5.1.2.15 The pan and tilt range capability of the PTZ cameras shall be sufficient to monitor the location.
- 5.1.2.16 The Automatic Number Plate Recognition (ANPR) cameras shall be provided at Depot and Station Vehicle Entrances and Exits.
- 5.1.2.17 ANPR cameras capture and digitalize images from license plates with very high precision (99% or more).
- 5.1.2.18 ANPR equipment shall work in complex/extreme conditions such as moving targets, very open angles, poor ambient light, fog, dirt, etc.
- 5.1.2.19 The CCTV cameras' images shall be free from interference or distortion.
- 5.1.2.20 The CCTV cameras' images shall be clear and sharp in all lighting conditions.
- 5.1.2.21 The CCTV cameras' images shall have an accurate color representation.

5.2 Environmental Conditions Requirements

- 5.2.1 The TSCC Contractor's CCTV system design shall be appropriate for, and resilient to, the local environmental and climatic conditions at each installation site.
- 5.2.2 All outdoor CCTV cameras shall be installed in weatherproof, CCTV camera housings that ensure the quality of the video image at a lower temperature and/or high humidity.



- 5.2.3 All outdoor CCTV cameras shall be protected against sunlight by sun protection.
- 5.2.4 Camera housing and housing accessories shall comply with APTA IT-CCTV-RP-001 (or later).
- 5.2.5 The CCTV system design shall be compliant (not limited to) to the international standards listed in Chapter 2.4, relevant to Lighting Protection.
- 5.2.6 CCTV cameras shall be protected from vandalism through cages or screens. The TSCC Contractor shall take prior approval from the Authority to ensure the locations of CCTV cameras on which these cages or screens should be installed.
- 5.2.7 Bird repellent spikes shall be used for outdoor CCTV cameras. The TSCC Contractor shall obtain prior approval from the Authority to ensure the locations of CCTV cameras on which these spikes should be installed.
- 5.2.8 All equipment shall be protected from damage or degradation in performance due to shock or vibration as experienced in the railway environment.

5.3 Operational Requirements for CCTV

- 5.3.1 The TSCC Contractor's CCTV System design shall ensure compliance with the California High-Speed-Rail operational rules and operational concept when (at least):
 - Defining the locations required for the placement of the CCTV equipment.
 - Defining messages, alarms, warnings, and notification levels and thresholds.
 - Developing alarm triggering procedures.
 - Implementing alarms, protocols, and procedures for the CCTV System.
- 5.3.2 The CCTV system shall include intelligent event detection and alerting capabilities to assist operators in identifying items of interest. The system shall minimize the need for continuous multi-screen monitoring by automatically highlighting relevant video feeds, such as motion detection, unauthorized access, loitering, or object abandonment, through visual or audible alerts in the ICSS. This shall enable focused operator response and reduce cognitive load.
- 5.3.3 The system shall allow the Operator to specify a date/time range and one or more CHSR System locations for which all associated CCTV recordings shall be retained beyond the standard retention period, until a specified date or until manually cleared, to support investigations or legal proceedings.
- 5.3.4 The system shall allow operators to tag and export video segments related to specific events and associate them with incident IDs or reports, with audit trails maintained for all exports.
- 5.3.5 Authorized personnel must have secure, Role Based Access Control permissions to retrieve video recordings from the CCTV system through a VMS at OCC. The TSCC Contractor shall obtain approval from the Authority for the user access rights and retrieval procedures for recording.
- 5.3.6 Operators shall be able to define and modify geo-fenced zones within the VMS using an intuitive graphical interface, with the ability to set activation time windows and object-type alert filters (e.g. person, vehicle, wildlife).
- 5.3.7 The system shall notify Operators of geo-fence breaches with clearly identifiable alerts, including the camera ID, location, object type detected, and timestamp.
- 5.3.8 The system shall allow Operators to acknowledge, silence, or escalate geo-fence alerts, with actions recorded in an audit log.



- 5.3.9 The VMS shall provide intuitive playback functionality, including timeline navigation, variable playback speeds, and filtering based on metadata such as date/time, camera, event type, or object classification.
- 5.3.10 The CCTV system shall support concurrent access by multiple authorized users, with user actions tracked in an audit log and mechanisms to avoid conflicting control of camera PTZ functions.

5.4 Functional Requirements for CCTV

5.4.1 General requirements

- 5.4.1.1 Normal operation of the CCTV system shall be performed via the Operator ICSS Workstation as part of the ICSS System.
- 5.4.1.2 The CCTV system shall be centrally managed, with the ability to assign different user rights and record event history (time, place, and ID).
- 5.4.1.3 CCTV cameras must be able to transmit, and the storage unit receivers must be able to accept at least two simultaneous, individually configured streams of different resolution and/or diverse types of coding.
- 5.4.1.4 In highly critical areas CCTV cameras shall provide at least two viewpoints to the video surveillance spot.
- 5.4.1.5 The CCTV system shall save all data that can be filtered per the desired parameters in the future.
- 5.4.1.6 The CCTV system shall save recording of events for playback and evidential purposes for a minimum of 30 days. Video recordings shall be allowed to specify start date, time duration, and export by the operator.
- 5.4.1.7 The CCTV system shall support an encryption mechanism during the video exportation process to ensure the integrity of the exported video.
- 5.4.1.8 The CCTV system shall offer a means to verify that no alteration of the exported video record was performed. All images must contain a digital signature to allow for the chain of evidence to be preserved as defined in APTA IT-CCTV-RP-001 (or later).
- 5.4.1.9 The CCTV system shall allow the Operator to save the exported video on external media (network drive, USB drive).
- 5.4.1.10 The CCTV system shall provide surveillance coverage at night and during inclement weather.
- 5.4.1.11 Recognition, Monitoring, Identification, and video analytic application functions shall be applied on all locations according to relevant design guidelines, if any, or shall be determined by the TSCC Contractor, and elaborated during the detailed design stage.
- 5.4.1.12 The CCTV System in the OCC shall be connected to all CCTV components across the CHSR System via the Digital Communication Network (DCN), with connectivity provided in a redundant architecture to ensure continuous operation.
- 5.4.1.13 The VMS shall provide a centralized event, end-user rights, and video recording distribution management.
- 5.4.1.14 The VMS shall be capable of remotely managing and configuring cameras and devices directly associated with the CCTV system from multiple vendors using open source and non-proprietary protocols such as the Open Network Video Interface Forum (ONVIF) Profile S.
- 5.4.1.15 The CCTV system shall be configurable for showing live video from a camera based on an alarm input from another sub-system, such as EACS and Fire Protection System.



5.4.1.16 In case of a safety and security-related incident, an audible alarm shall be triggered, and the image of the best-positioned CCTV camera shall be automatically displayed to a predefined monitor at the OCC. The alarm shall be acknowledged by the Operator to silence the alarm.

5.4.1.17 The safety and security-related incidents shall include, but not be limited to intrusion, unauthorized access, fire detection, direct line telephone calls, falling vehicle detection, falling object detection, wildlife detection, and overcrowding.

5.4.2 CCTV coverage requirements

5.4.2.1 The CCTV Coverage shall be provided at Stations, including but not limited to:

- 95% of the Concourse and Platform areas.
- Access to the Back of the House, including Equipment Rooms.
- All corridors.
- All paid and unpaid areas.
- All cash and ticket offices.
- Ticket gate barrier lines and the approach/run-off areas on each side.
- Cash handling areas and along the cash transfer route.
- All station entrances, Emergency exits, and their associated run-off areas.
- External station pathways to cover the linkway or path towards the Carpark (if any).
- Passenger Intercom points in strategic areas.
- Platform emergency stop plungers.
- Strategic access control points.
- All stairs and escalators, together with associated landing areas.
- Inside the Strong Room.
- The interior of all elevators.
- Other areas, if any, as required by operation and security.

5.4.2.2 The CCTV Coverage shall be provided at facilities, including but not limited to:

- All entrances/exits into the depot area.
- All entrances to and within secure areas such as the Operations Control Center.
- Depot perimeter fences.
- The automatic train wash plant.
- Substations.
- Stabling area, maintenance tracks.
- Workshops.
- Car park area.
- Interior of elevators.
- Fire escape routes.
- All buildings in the depot area.
- Other areas, if any, as required by operation and security.



5.4.3 The CCTV Coverage shall be provided at wayside facilities, including but not limited to:

- Shelter sites.
- Radio sites.
- Equipment cabinet sites.
- Traction Power substations.
- Tunnel & trench portals.
- Transfer Tracks
- Other areas, if any, as required by operation and security.

5.4.4 Surveillance of forecourt, access to the depot building, the station's building, parking, and perimeter around the building shall be enabled by CCTV cameras:

- inner perimeter = standoff distance (up to 15 – 30m from building envelope) shall provide at least recognition level.
- outer perimeter (behind the inner perimeter) – shall provide at least a monitoring level.

5.4.5 Surveillance of entrances and exits to the station building (both staff and passengers) shall be enabled by CCTV cameras with an identification analytic video application function.

5.4.6 Surveillance of key points such as the start and end point of passenger flows shall be enabled by CCTV cameras with recognition and identification analytic video application function.

5.4.7 Surveillance of ticket office, validation gates, if any, and area close to gates, platforms shall be enabled by CCTV cameras with identification analytic video application function.

5.4.8 Surveillance of equipment rooms and access to the Back of the House area shall be enabled by CCTV cameras with an identification analytic video application function.

5.4.9 Surveillance of elevators shall be enabled by CCTV cameras with an identification analytic video application function.

5.4.10 Video Analytics System (VAS)

5.4.10.1 The VAS shall use Machine Learning and Deep Learning algorithms to enable real-time detection, classification, and tracking of objects, people, and events in CCTV footage, enhancing security through automated threat identification and behavior analysis.

5.4.10.2 The VAS shall continually improve its effectiveness and performance using machine learning.

5.4.10.3 The trained video analytics models, developed using Machine Learning and Deep Learning algorithms, shall be immediately functional upon deployment without requiring an on-site learning period.

5.4.10.4 All video analytics models, both server and edge-based, shall be designed to meet the precise detection (above 98%) and classification (above 95%) rates required.

5.4.10.5 The VAS shall also allow for certain adjustments to finetune its performance according to the specific user needs of the Operator.

5.4.10.6 The VAS shall provide a fine adjustment of the alerts it sends to the ICSS.

5.4.10.7 The VAS shall maximize its effectiveness by minimizing false alarms and maintaining a high detection accuracy, with a goal to keep the false alarm rate below 3%.

5.4.10.8 The Operator shall be able to easily dismiss alarms as false alarms and the VAS shall apply learnings to the models.



- 5.4.10.9 The VAS shall seamlessly integrate with the VMS, generating metadata that facilitates alert generation and subsequent incident search.
- 5.4.10.10 The CCTV system shall provide a variety of automatic analytics options for detection of anomalous events in locations as determined by the TSCC Contractor via a risk assessment process in conjunction with Security, Operations, and Maintenance personnel.
- 5.4.10.11 Video analytics available for use shall be at a minimum, as described APTA Video Content Analytics (VCA) Recommended Practice Transit Applications Draft (www.tswg.org); APTA IT-CCTV-RP-001 (or later) as issued at the time of NTP.
- 5.4.10.12 CCTV system shall support and shall implement video analytics applications, including, but not limited to: stop vehicle detection, overcrowding (or crowd density) application, intrusion detection and cross line detection, left objects detection, tailgating, tampering, automatic tracking, loitering, face recognition, person of interest tracking, virtual border crossing detection and automatic emergency detection.
- 5.4.10.13 The alert function or action the system should take when an event is detected shall be applicable with the requirement specified in APTA IT-CCTV-RP-001 (or later).
- 5.4.10.14 The CCTV system shall support the configuration of geo-fenced zones by the Operator using the VMS, allowing virtual perimeters to be defined on a map or video overlay for specific areas within the CHSR System.
- 5.4.10.15 Each geo-fenced zone shall support the assignment of an activation period, including start date/time, end date/time, or a permanent (always-on) status.
- 5.4.10.16 The system shall associate all cameras covering a geo-fenced area with that zone automatically or through Operator assignment, enabling intelligent event detection within the defined perimeter.
- 5.4.10.17 The system shall be capable of detecting and classifying intrusions into geo-fenced zones by persons, vehicles, and wildlife, based on video analytics.
- 5.4.10.18 Upon detection of an intrusion within an active geo-fenced zone, the system shall generate real-time audible and visual alarms to the Operator via the ICSS.
- 5.4.10.19 Geo-fencing alerts shall be retained with associated video clips for post-incident review, searchable by zone name, object type, and time.

5.5 Performance Requirements for CCTV

5.5.1 General Requirements

- 5.5.1.1 The image sensor used in CCTV cameras must match the image resolution used for at least 1:1. CCTV cameras with the actual pixel count of the image sensor lower than that of the image shall not be allowed.
- 5.5.1.2 The compression system of CCTV should be configured to allow at least H.264 or H.265. In the event of any conflict between this specification and referenced standards or guidelines, the TSCC Contractor shall apply the latest proven and widely accepted technology and industry practices that fulfill the intended functional requirements.
- 5.5.1.3 The signal-to-noise ratio of the CCTV cameras shall not be less than 50 db.
- 5.5.1.4 CCTV cameras need to meet the required parameters of a good surveillance CCTV camera by their technical characteristics, i.e., have auto-iris lenses, high light sensitivity, etc.



- 5.5.1.5 The CCTV recordings for each connected camera shall be at 4K, 25fps, and 16:9 aspect ratio resolution.
- 5.5.1.6 The NVRs in the OCC shall enable storage of all footage for a minimum of 30 days, or as otherwise agreed with the Authority.
- 5.5.1.7 Backup central recording of the NVRs in OCC shall enable backup of footage from the local NVRs (depot, stations, or wayside facilities) for at least 30 days.
- 5.5.1.8 The local NVRs in stations, depots, or any wayside facilities shall enable storage of all footage for at least 30 days.
- 5.5.1.9 Local storage of video recordings in the event of a loss of connection between the CCTV camera and the network video recorder shall enable storage of all footage for at least 7 days.
- 5.5.1.10 The NVRs shall provide a spare recording capacity of 20% in each location.
- 5.5.1.11 The incident-based video recordings must be retained for a minimum of 90 days or as otherwise agreed with the Authority to ensure sufficient time for investigation and compliance with regulatory requirements.
- 5.5.1.12 All live and recorded video streams shall contain text identifying camera location, date, time, and be synchronized with the Network Timing System (NTS).
- 5.5.1.13 CCTV cameras shall use either open standard or non-proprietary protocols for communicating with the CCTV and video management systems, such as the Open Network Video Interface Forum (ONVIF) Profile S.

5.5.2 Safety Requirements

- 5.5.2.1 The CCTV system shall comply with the safety requirements defined in the Schedule 1.

5.6 RAM Requirements

- 5.6.1.1 The CCTV system shall comply with the RAM requirements defined in Schedule 1 and the Authorities' RAM management plan.

5.7 Cybersecurity and Security Requirements

- 5.7.1 The TSCC Contractor's design for CCTV shall be in full compliance with the Authority's cybersecurity policies and Cybersecurity Technical Specification.
- 5.7.2 The CCTV system shall implement Role Based Access Control (RBAC), with user roles defined according to their responsibilities and corresponding access permissions.
- 5.7.3 Individual user accounts shall be created for authorized personnel who need access to the CCTV system.
- 5.7.4 Each user shall have a unique username and password for authentication and audit purposes.
- 5.7.5 Strong Password Policies shall be enforced.
- 5.7.6 User Access Control shall be used to control:
 - user access to specific cameras, video streams, or areas within the CCTV system.
 - user access to specific functions within the CCTV system.
 - user access to viewing and exporting recordings.
- 5.7.7 The CCTV system shall provide appropriate access security measures to prevent the connection of unauthorized devices.



- 5.7.8 The CCTV system shall maintain audit logs of user access, configuration changes, video export activities, and system events. These logs shall be secured and retained in accordance with the Authority's data retention policy.
- 5.7.9 The CCTV system shall encrypt data in transit and at rest using industry-standard encryption protocols.
- 5.7.10 The TSCC Contractor shall ensure that all components of the CCTV system receive timely security patches and firmware/software updates.
- 5.7.11 CCTV systems shall have a System Owner who shall be accountable for cybersecurity risk ownership and mitigation.
- 5.7.12 The System Owner shall ensure that cybersecurity risk assessments and threat modelling exercises are appropriately resourced.
- 5.7.13 CCTV Camera procurement shall be informed by the cybersecurity technical specification requirements to ensure that vulnerable devices are not procured.
- 5.7.14 Any connectivity to CCTV cameras shall be strictly controlled and documented, many CCTV cameras have an associated cloud-based application for remote monitoring purposes, where these solutions are used, they must be co-engineered with the Cybersecurity Lead.
- 5.7.15 Power over Ethernet networks and devices used for CCTV cameras must be compliant with the network security requirements outlined in the Cybersecurity Technical Specification.



6 INTERFACES REQUIREMENTS

6.1 General Requirements

6.1.1 Interfaces are classified as below:

- Third Party interfaces: interfaces between TSCC systems and systems provided by Third Party (excluding CHSR contractors);
- External interfaces: interface between TSCC systems and systems provided by CHSR contractors (Civils Packages, Stations contractor, Facilities contractor, Solar PV and BESS contractors);
- Internal interfaces between systems within the TSCC scope.

6.1.2 The TSCC Contractor shall develop design considering the identified Third Parties, External and Internal interfaces to ensure the required functionalities and performance described in this specification.

6.1.3 The TSCC Contractor shall, if necessary, propose any additional interfaces required to ensure the functionalities and performance described in this specification.

6.1.4 The TSCC Contractor shall achieve interoperability by also proactively managing the interfaces between the various System and Sub-System elements.

6.2 External Interface for CCTV

6.3 External Interfaces – facilities contractor

6.3.1 Visible equipment shall be integrated harmoniously with the architecture of the facilities.

6.3.2 The TSCC Contractor shall design and deploy a suitable CCTV system in every location, in coordination with civil and architectural teams.

6.3.3 The TSCC Contractor shall coordinate with all interfacing parties (Civil, E&M, etc.) to ensure an unobstructed field of view and proper lighting conditions for every camera.

6.3.4 The TSCC Contractor shall interface with the facilities contractor regarding the installation of CCTV inside the elevators.

6.3.5 The TSCC Contractor shall install all Telephony core network equipment in the OCC being provided by the facilities contractor.

6.3.6 The TSCC Contractor shall provide to the facilities contractor:

- Equipment dimensions
- Equipment clearances requirements
- Equipment mounting and fixings requirements
- Cable routes/containment requirements
- Equipment loadings
- Installation and maintenance requirements
- Equipment heating loads
- Equipment cooling loads
- Equipment hydraulic requirements

6.3.7 To be provided by facilities contractor to accommodate the TCSS equipment installation and operational/maintenance requirements:



- Room dimensions and layouts
- Room facilities (Plumbing, HVAC, Lighting, Fire Protection Systems, Doors, electricity)
- Room raised floor system
- Delivery access routes.
- Maintenance access routes

6.4 External Interfaces – stations contractor

- 6.4.1 Visible equipment shall be integrated harmoniously with the architecture of the stations.
- 6.4.2 The TSCC Contractor shall design and deploy a suitable CCTV system in every location, in coordination with civil and architectural teams.
- 6.4.3 The TSCC Contractor shall coordinate with all interfacing parties (Civil, E&M, etc.) to ensure an unobstructed field of view and proper lighting conditions for every camera.
- 6.4.4 The TSCC Contractor shall interface with the station contractors regarding the installation of CCTV inside the elevators.
- 6.4.5 The TSCC Contractor shall provide to the station contractor:
- Equipment dimensions
 - Equipment clearances requirements
 - Equipment mounting and fixings requirements
 - Cable routes/containment requirements
 - Equipment loadings
 - Installation and maintenance requirements
 - Maintenance access routes

6.5 Internal Interfaces

6.5.1 Interface with Digital Communications Network (DCN)

- 6.5.1.1 The CCTV system shall have an interface with the Digital Communications Network (DCN) for the transport of CCTV data in a secure and reliable way and the interconnection of all CCTV devices along the California High-Speed-Rail Line.

6.5.2 Interface with Network Timing System (NTS)

- 6.5.2.1 The CCTV system shall have an interface with the Network Timing System (NTS) to ensure accurate current timestamping and to provide time synchronization to the CCTV System.

6.5.3 Interface with Telephony System

- 6.5.3.1 The CCTV system shall have an interface with the Telephony System to trigger the transfer of corresponding video sequences to the Operators via the ICSS workstation.

6.5.4 Interface with Electronica Access Control System (EACS)

- 6.5.4.1 The CCTV system shall have an interface with the EACS System to trigger the transfer of corresponding video sequences to the Operators via the ICSS workstation.

6.5.5 Interface with Fire Protection System



6.5.5.1 The CCTV system shall have an interface with the Fire Protection System to trigger the transfer of corresponding video sequences to the Operators via the ICSS workstation.

6.5.6 Interface with Low Voltage Power System

6.5.6.1 The CCTV system shall have a redundant interface with the Low Voltage Power System to ensure an uninterruptible power supply.

6.5.7 Interface with Integrated Control and Supervision System

6.5.7.1 The CCTV system shall have an interface with the ICSS System on standard protocols to allow status monitoring of the CCTV equipment.

6.5.7.2 All detected CCTV system faults and major alarms shall be reported to the ICSS. The faults shall include, but not be limited to, hardware failures, image quality, and recording issues.

6.5.7.3 The CCTV system shall report image quality faults to the ICSS, including but not limited to camera out of focus, camera image distortion, change in camera orientation, and change of field of view.

6.5.7.4 The ICSS shall trigger the CCTV system for the transfer of video sequences corresponding to alarms received by the ICSS from CHSR subsystems.

6.5.8 Interface with Enterprise Asset Management Systems (EAMS)

6.5.8.1 The CCTV System shall provide static Asset Information and dynamic Asset Information to the EAMS for maintenance activities and asset lifecycle management activities.



7 MATERIALS, PRODUCT AND COMPONENTS REQUIREMENTS

7.1 General Requirements

- 7.1.1 All materials supplied shall conform to the requirements and test methods of the relevant EN standards or other applicable recognized standards. Refer to 2.4.
- 7.1.2 All materials supplied shall be of sufficient grade and quality to meet the design life requirements.
- 7.1.3 The CCTV System shall be complete with all equipment, supporting structures, hardware, licenses, software, cabling, and ancillary services which are useful for efficient operation of the CCTV System components. Such accessories and materials shall be deemed to be within the scope of this specification, whether specifically mentioned or not.
- 7.1.4 All special tools and test equipment intended for the configuration of the CCTV System shall be deemed to be within the scope of this specification, whether specifically mentioned or not.

7.2 Software and Hardware Requirements

- 7.2.1 Virtualized, cloud (on-premises) solutions may be proposed by the TSCC Contractor.
- 7.2.2 All central servers may be on-premises or virtualized machines to ease systems evolution, complying with the Cybersecurity requirements.
- 7.2.3 The CCTV cameras shall be protected against the electrical and magnetic atmosphere that exists in a typical electrified railway environment.
- 7.2.4 Low toxicity, low smoke emission, low flammability, zero halogen fire retardant cable shall be used for the distribution power and signals to the CCTV cameras.
- 7.2.5 Third parties' cloud solutions, or third-party video data processing shall not be allowed.
- 7.2.6 Hot-swappable elements, such as fans and power supplies, should be swappable without tools.
- 7.2.7 The Operating of all the IT/Network devices shall be provided the latest stable release.
- 7.2.8 All the application software shall be upgraded to the latest stable release and shall support all the requirements specified.
- 7.2.9 For the housing accessories, a minimum housing rating shall be IP66 as defined in section 2.12.1 NEMA environmental rating in APTA IT-CCTV-RP-001 (or later).

7.3 EMC Requirements

The CCTV system shall be fully immune and protected from any Electromagnetic Interference (EMI) with the traction power, multi-tubular cabling, and Radio Frequency Interference (RFI). The EMI emissions shall be mitigated in accordance with applicable standards EN 50122 or APTA IT-CCTV-RP-001 (or later) or equivalent.



8 TOLERANCES

Not applicable to CCTV system.



9 SCOPE OF SUPPLY AND DELIVERY

9.1 General Requirements

9.1.1 The TSCC Contractor shall supply and deliver all components related to the CCTV System as per Schedule 16.

9.2 Specific Requirements

9.2.1 The CCTV System scope of supply and delivery shall include (not limited to):

- Central and local servers.
- Video walls and video wall controller (if needed)
- CCTV cameras.
- Amplifiers/Injectors (if needed).
- Cabling and connectors.
- Racks.
- Software architecture, including full definition of protocols used.
- Video Management System.
- Network Video Recorders.
- Video Analytics System
- HW/SW licenses.
- Auxiliary elements and gear (cases, bird repellent spikes, attachments, bindings, testing equipment, etc.).
- Spare parts.
- Maintenance laptops.



10 MANUFACTURING

10.1 General Requirements

10.1.1 General manufacturing requirements are defined in the Scope of Work.



11 INSTALLATION AND INTEGRATION

11.1 General Requirements

11.1.1 General installation and integration requirements are defined in the Scope of Work and Schedule 3.



12 TESTING & ACCEPTANCE

12.1 General Requirements

12.1.1 General installation and integration requirements are defined in the Scope of Work and Schedule 3.

12.2 Specific Requirements

12.2.1 Failure event test cases, Interface test cases, video analytic functions test scenarios and the following information (not limited to) shall be recorded and reported during the test procedure:

- In the event of the main central recording or local recording failure, backup shall be taking place as the master one.
- In the event of video management solution main central server failure, backup shall be taking place as the master one.
- All interface tests that trigger the CCTV systems to be automatically recorded and displayed to a predefined monitor, e.g., direct telephone line, EACS, FPS, etc.
- Video analytic alert function test scenario according to the system requirement in APTA IT-CCTV-RP-001 (or later) e.g. Stop vehicle detection, Overcrowding (or crowd density) application, Intrusion detection and cross line detection, left objects detection, Tailgating, Tampering, Automatic tracking, Loitering, Face recognition, Virtual border crossing detection and Automatic emergency detection. A decision should be made regarding what type of activity should trigger an alert and then what form that alert should take.

12.2.2 CCTV camera fields of view shall be tested in the field to demonstrate that the live and recorded images meet the intended function and specification identified by the TSCC Contractor.

12.2.3 CCTV field of view study report shall be submitted for the Authority's approval.



13 SUBMITTALS

13.1 General Requirements

13.1.1 General submittal requirements are specified in the Scope of Work.



14 QUALITY MANAGEMENT

14.1 General Requirements

14.1.1 General quality management requirements are defined in the Agreement and associated Schedules.



15 ADDITIONAL INFORMATION REQUESTED

15.1 General Requirements

- 15.1.1 In addition to the mandatory requirements outlined in this specification, the Authority reserves the right to request from the TSCC Contractor information pertaining to the performance of proposed or supplied elements under similar service conditions, with particular emphasis on railway management aspects which may influence CCTV subsystem reliability, availability, and maintainability characteristics.



16 LOGISTICS

16.1 General Requirements

16.1.1 General logistics requirements are defined in the Agreement.

APPENDIX A TO EXHIBIT 5(K) CLOSED-CIRCUIT TELEVISION (CCTV)

