

Schedule 5(n)

Public Address and Customer Information System (PACIS)

California High-Speed Rail Authority



Standard Specifications

TSCC Specifications

SPEC-0018 – Public Address and Customer Information System
(PACIS)

Rev. 0.0

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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 Public Address and Customer Information System (PACIS) system, hereinafter: PACIS.
- 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 PACIS 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 12 – Communication Systems and Train Control
[R2]	AREMA Standards	Chapter 17 – High-Speed Rail Systems

TABLE 52 DESIGN GUIDELINES

2.3 TSI

- 2.3.1 There are no applicable TSIs for the PACIS.

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	Standard	Title
[R3]	EN 11205	Acoustics - Noise emitted by machinery and equipment - Engineering method for the determination of emission sound pressure levels in situ at the workstation and at other specified positions using sound intensity
[R4]	EN 300 386	Telecommunication network equipment; Electro Magnetic Compatibility (EMC) requirements; Harmonized Standard covering the essential requirements of the Directive 2014/30/EU
[R5]	EN 50121	Railway Applications – Electromagnetic Compatibility
[R6]	EN 50121-3-2	Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus
[R7]	EN 50121-4	Railway applications - Electromagnetic compatibility - Part 4: Emission and immunity of the signaling and telecommunications apparatus
[R8]	EN 50121-5	Railway applications - Electromagnetic compatibility Emission and immunity of fixed power supply installations and apparatus
[R9]	EN 50122-1	Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock
[R10]	EN 50124	Railway applications - Insulation coordination
[R11]	EN 50125	Railway applications - Environmental conditions for equipment
[R12]	EN 50125-3	Railway applications - Environmental conditions for equipment - Part 3: Equipment for signalling and telecommunications



ID	Standard	Title
[R13]	EN 50126	Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
[R14]	EN 50126-1	Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process
[R15]	EN 50126-2	Railway applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 2: Systems Approach to Safety
[R16]	EN 50128	Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems
[R17]	EN 50159	Railway applications - Communication, signalling and processing systems - Safety-related communication in transmission systems
[R18]	EN 50164	Lightning Protection Components
[R19]	EN 50164-3	Lightning Protection Components (LPC) -- Part 3: Requirements for isolating spark gaps
[R20]	EN 50173	Information technology - Generic cabling systems
[R21]	EN 50174	Information technology - Cabling installation
[R22]	EN 50289-1-6	Communication cables - Specifications for test methods - Part 1-6: electrical test methods - Electromagnetic performance
[R23]	EN 50310	Application of equipotential bonding and earthing in buildings with information technology equipment
[R24]	EN 50849	Sound systems for emergency purposes
[R25]	EN 54-14	Fire detection and fire alarm systems - Part 14: Guidelines for planning, design, installation, commissioning, use and maintenance
[R26]	EN 54-16	Fire detection and fire alarm systems - Part 16: Voice alarm control and indicating equipment
[R27]	EN 54-24	Fire detection and fire alarm systems - Part 24: Components of voice alarm systems - loudspeakers
[R28]	EN 55024	Information technology equipment. Immunity characteristics. Limits and methods of measurement
[R29]	EN 60065	Audio, video and similar electronic apparatus - Safety requirements
[R30]	EN 60118-4	Hearing Aids - Part 4: Magnetic Field Strength in Audio-Frequency Induction Loops for Hearing Aid Purposes
[R31]	EN 60268-16	Sound system equipment - Part 16: Objective rating of speech intelligibility by speech transmission index
[R32]	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
[R33]	EN 60332-1-2	Tests on electric and optical fibre cables under fire conditions Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame



ID	Standard	Title
[R34]	EN 60529	Degrees of protection provided by enclosures (IP Code)
[R35]	EN 60664-1	Insulation coordination for equipment within low-voltage systems -- Part 1: Principles, requirements and tests
[R36]	EN 60715	Dimensions of low-voltage switchgear and control gear. Standardized mounting on rails for mechanical support of switchgear, control gear and accessories
[R37]	EN 60754-2	Test on gases evolved during combustion of materials from cables – Part 2: Determination of acidity (by pH measurement) and conductivity
[R38]	EN 61000-6	Electromagnetic compatibility (EMC) - generic standards
[R39]	EN 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
[R40]	EN 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
[R41]	EN 61034	Measurement of smoke density of cables burning under defined conditions
[R42]	EN 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
[R43]	EN 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (ik code).
[R44]	EN 62305	Protection against lightning
[R45]	ETSI EN 301 462	Human Factors (HF); Symbols to identify telecommunications facilities for deaf and hard of hearing people
[R46]	GTFS	General Transit Feed Specification
[R47]	IEC 60068	Environmental testing
[R48]	IEC 60331	Tests for electric cables under fire conditions
[R49]	IEC 60364	Low-voltage electrical installations (equivalent to HD 384 series)
[R50]	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
[R51]	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
[R52]	IEC 61000-5-2	Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling
[R53]	IEC 61643	Low-voltage surge protective devices
[R54]	IEEE 1220	IEEE Standard for Application and Management of the Systems Engineering Process
[R55]	IEEE 1588	IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems
[R56]	IEEE 60068-2-1	Environmental testing - Part 2-1: Tests - Test A: Cold
[R57]	IEEE 60068-2-30	Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
[R58]	ISO 11064	Ergonomic design of control centers



ID	Standard	Title
[R59]	ISO 9001	Quality management systems — Requirements
[R60]	ISO/CEI 15288	Systems engineering - Systems life cycle processes
[R61]	NFPA 780	Standard for the Installation of Lightning Protection Systems
[R62]	RFC 7384	Security Requirements of Time Protocols in Packet-Switched Networks
[R63]	NFPA72	National Fire Alarm and Signaling Code
[R64]	NFPA 130	Standard for Fixed Guideway Transit and Passenger Rail Systems
[R65]	2010 ADA	2010 ADA Standards for Accessible Design
[R66]	UL2900 series	Cybersecurity for Network-Connectable Products
[R67]	TSA SD 1580/82-2022	Cybersecurity Requirements for High-Risk Rail Operators

TABLE 53 LIST OF APPLICABLE STANDARDS

2.5 Other Documents

2.5.1 The following documents shall be referred:

ID	Document	Title
[R68]	Schedule 16	Scope of Work
[R69]	Schedule 5(a) SPEC-0005	Cybersecurity Technical Specification
[R70]	Schedule 3	Safety, Security and RAM Requirements

TABLE 54 OTHER DOCUMENTS

3 TERMS, DEFINITIONS, AND ABBREVIATIONS

3.1 Terms, Definitions and Abbreviations

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



4 SYSTEM DESCRIPTION

4.1 Purpose of the PACIS

- 4.1.1 The PACIS consists of the Public Address System (PAS) and the Customer Information System (CIS).
- 4.1.2 The purpose of the Public Address System (PAS) is to provide audible information to facilitate the movement of passengers and inform them of operating conditions (arrivals, departures, hazards...) by means of broadcasting both manual and automated audio announcements. Announcements can also be emergency announcements, such as evacuation announcements, not only for passenger stations but also for any other facilities of the California High-Speed Rail System.
- 4.1.3 The purpose of the Customer Information System (CIS) is to provide visual information to passengers at station entrances, concourses, and platforms of the California High-Speed-Rail System.

4.2 PACIS System Definition

- 4.2.1 The PACIS provides users with audio announcements and visual messages for the following:
 - Train service information.
 - Safety and security information.
 - Emergency and evacuation information.
 - Information about user facilities at the station.
 - Local transit connection details.
 - Authority-controlled advertising.
- 4.2.2 The PACIS information, which is real-time and synchronized, shall be delivered to users via:
 - Audio announcements.
 - Visual messages
 - Digital content made available to apps and browsers on users' smartphones, computers, and other communicating devices and platforms.
 - Audio announcements accessible via T-coil receivers.
- 4.2.3 The PAS shall include, but not be limited to, the following equipment: loudspeakers, Dynamic Ambient Noise Sensors (DANS), interfaces, amplifiers, microphones, PA consoles, PAS NMS, necessary cables, and HMI functionality via ICSS workstation for both normal and emergency voice evacuation announcements and background music.
- 4.2.4 The CIS shall include, but not be limited to, the following equipment: Passenger Information Displays (PIDs), CIS NMS, necessary cables, and HMI functionality via ICSS workstation for both normal and emergency messages.

4.3 PACIS System Operational Context

- 4.3.1 The mission of the PACIS system is to provide reliable visual and audible information to the passengers and staff in compliance with the operational needs.
- 4.3.2 The PACIS shall be operated according to the CHSR operational procedures.

4.4 Design Life

- 4.4.1 The design life requirements of the PACIS shall be 30 years.
- 4.4.2 The design life requirements of the PACIS shall allow for the pertinent evolution and technological change of the PACIS system throughout its life to ensure it remains fit for purpose.



- 4.4.3 The TSCC Contractor shall ensure that PACIS 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 PACIS system components (with equal or compatible technical specifications) for the entire design life required.



5 SYSTEM REQUIREMENTS

5.1 General Requirements

- 5.1.1 The PACIS shall be designed in accordance with the requirements described in this specification.
- 5.1.2 The Public Address System (PAS) shall be deployed in passenger stations, depots, OCC Building,, Stations, car parks, and any other facilities required for the California High-Speed-Rail System.
- 5.1.3 The Customer Information System (CIS) shall be deployed in passenger stations (station entrances, concourses, platforms, and any other place where there will be passengers waiting or in transit).
- 5.1.4 An integrated system for PACIS should be delivered by the TSCC Contractor, with redundant PACIS central servers in the OCC (i.e., No single points of failure) and connected with the PACIS station servers/controllers through the Digital Communications Network (DCN). Any other approach by the TSCC Contractor shall be properly justified, ensuring that a greater level of functionality, greater flexibility, reduced lifecycle cost, improved sustainability, etc. are provided.
- 5.1.5 The PACIS information shall be available in English and Spanish.
- 5.1.6 The PACIS design shall align with the California High-Speed-Rail 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.
- 5.1.7 The TSCC Contractor's PACIS design shall respect and adapt to the architectural designs of stations and other facilities to avoid impacts in the constructive elements of the different facilities and shall fit and be installed harmoniously.
- 5.1.8 Ensuring compliance with the previous requirement, PACIS elements may be installed over existing station/facility infrastructure, ensuring that the overall performance of the PACIS is not compromised.
- 5.1.9 The PACIS design shall meet the ADA (Americans with Disabilities Act) requirements to guarantee the accessibility for persons with disabilities and persons with reduced mobility regarding ticketing, information desks, customer assistance points, visual information (signposting, pictograms, printed or dynamic information), spoken information, induction loops, etc.
- 5.1.10 The PACIS equipment shall be placed in locations that do not obstruct or encroach upon pedestrian access or movement paths.
- 5.1.11 The Passenger Information Displays (PIDs) at platforms shall be double-sided and legible from 25 meters under all ambient lighting conditions.
- 5.1.12 The distance between the PIDs shall be a maximum of 50 meters.
- 5.1.13 The lower edge of all PIDs shall be mounted at a minimum height of 2.5 meters above floor level.
- 5.1.14 Only PACIS systems with service-proven records for application on railway infrastructure shall be proposed by the TSCC Contractor.
- 5.1.15 Where integration with other public transport modes is planned at the California High-Speed-Rail stations (for example airport, metro, tram and bus), passenger information from this external transport modes shall be shown in separate displays from those used for railways.
- 5.1.16 PACIS shall display an accurate and up-to-date train timetable and scheduling information at all times. Real-time information shall be displayed to passengers that changes dynamically, based upon the status of the railway operations.
- 5.1.17 Time and date information shall be connected and received from the Network Timing System (NTS).
- 5.1.18 The PACIS shall be interfaced with the Fire Protection System to enable pre-recorded evacuation or emergency messages and hence shall meet the highest availability standards.
- 5.1.19 Emergency announcements shall take precedence and override normal live and pre-recorded announcements.



5.1.20 The PACIS shall be available and operational on a 24/7 basis.

5.2 Environmental Conditions Requirements

- 5.2.1 The TSCC Contractor's PACIS system design shall be appropriate for, and resilient to, the local environmental and climatic conditions at each installation site.
- 5.2.2 All equipment shall be protected from damage or degradation in performance due to shock or vibration as experienced in the railway environment.
- 5.2.3 The IP rating of the outdoor equipment shall be at least IP65.
- 5.2.4 All outdoor equipment that is directly exposed to the sun shall be UV-protected.
- 5.2.5 The PIDs shall be robust enough in design to ensure 100% protection from water, dust, lightning, rust, and any other environmental condition for the locations where each PID is to be installed.
- 5.2.6 The screens shall be protected against vandalism. The housing shall be vandal-resistant up to IK08 for indoor use and IK10 for outdoor use, and graffiti-resistant.
- 5.2.7 Bird repellent spikes shall be used for outdoor screens. The TSCC Contractor shall obtain prior approval from the Authority to ensure the locations of screens on which these spikes should be installed.
- 5.2.8 All PID and PAS equipment shall comply with Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) directives for electronic waste and hazardous substances, and a component take-back or recycling plan shall be provided.

5.3 Operational Requirements for PACIS

- 5.3.1 The TSCC Contractor's PACIS design shall ensure compliance with station architecture design and the California High-Speed-Rail operational rules when:
 - Defining the locations required for the placement of the displays and the audio devices (speakers) to convey information to passengers and staff.
 - Establishing messages, alarms, warnings, and notification levels and thresholds.
 - Developing alarm triggering procedures that adhere to the California High-Speed-Rail System.
 - Implementing alarms, protocols, and procedures for the PACIS.
- 5.3.2 The PACIS shall allow the Operators to operate and maintain the main line and related local facilities as described in the concept of operations.

5.4 Functional Requirements for PACIS

5.4.1 General

- 5.4.1.1 The PACIS shall comply with the following minimum functional requirements.
- 5.4.1.2 Normal operation of the PACIS shall be performed via the Operator ICSS Workstation as part of the ICSS System.
- 5.4.1.3 The PACIS central servers shall be in the OCC, and the local servers shall be in stations.
- 5.4.1.4 A downgraded mode shall be considered in the event of a failure of connection with the OCC central server, so the local equipment at the station can take over.
- 5.4.1.5 Communication between the different PACIS of each station shall be done via the DCN aligned with the cybersecurity and operational policies of the California High-Speed-Rail System.
- 5.4.1.6 PACIS HMI on ICSS workstation shall have functionality of transmitting video/audio files to the display screens and PAS for public addressing, advertisement, and commercial purposes.
- 5.4.1.7 PACIS announcements shall be managed from the OCC.



- 5.4.1.8 The PACIS shall support the definition of different priorities for emergency messages. The emergency messages with higher priority shall interrupt any lower priority current announcements
- 5.4.1.9 Depending on the triggering input signals, pre-recorded/computerized emergency messages shall be automatically broadcast to pre-defined areas within the California High-Speed-Rail stations.
- 5.4.1.10 The PACIS shall be able to broadcast voice and display visual messages simultaneously when needed, depending on the type of information (e.g., evacuation and emergency messages, etc.).
- 5.4.1.11 The PACIS shall be synchronized appropriately to provide coherent passenger information (especially for the visually impaired people).
- 5.4.1.12 The PACIS shall comply with NFPA 130 - Standards For Fixed Guideway Transit and Passenger Rail Systems.
- 5.4.1.13 The PACIS system shall comply with Emergency Voice/Alarm Communication Systems (EVACS) requirements contained within the National Fire Alarm and Signaling Code (NFPA 72).
- 5.4.1.14 All audio announcements from loudspeakers shall provide good speech intelligibility as measured using the STI-PA metric and the STI-PA score shall meet the requirements of NFPA 72 in all locations for emergency announcements.
- 5.4.1.15 The PACIS shall be fed by the train control system and automatically updated. For this reason, interfaces to the train control system shall be provided to receive real-time traffic information using the General Transit Feed Specification (GTFS) format or a similar format agreed upon with the Authority.
- 5.4.2 Public Address System (PAS)**
- 5.4.2.1 The Public Address System (PAS) shall enable the Operator to address the passengers, the public, employees, and operation and maintenance staff with clearly understandable audio announcements on all areas of the CHSR System without disturbing the public unreasonably.
- 5.4.2.2 The PAS shall be installed at strategic locations such as OCC, stations, platforms, depots, maintenance facilities/workshops, traction power substations, and shelter sites, etc., aligned with stations and facilities' architectural design and shall support manual and automated audio announcements.
- 5.4.2.3 Various types of loudspeakers shall be installed throughout the railway line in accordance with the installation location. It is recommended that the speakers include the following types:
- Ceiling mount speaker.
 - Wall mount speaker.
 - Column mount speaker.
 - Sound projector.
 - Horn speaker.
- 5.4.2.4 The PAS shall cover the whole station building and the nearest outdoor area at the station building, where the main person flows and crowded areas are anticipated.
- 5.4.2.5 The PAS shall broadcast the following message types (not limited to):
- Automatic train announcements prior to the train's arrival at the station (configurable period).
 - Live, pre-recorded, and computerized messages (Text to speech).
 - Music and advertisements.
 - Gong and siren generator.
- 5.4.2.6 The PAS shall allow broadcasting automatic announcements as well as bursting/manual announcements when required and shall provide the facilities to support pre-recorded announcements



(verbal and speech synthesis) in English and Spanish from stations and/or OCC to the complete station public area (platforms and concourses).

- 5.4.2.7 The PAS information shall transit from the OCC to stations and other locations, making use of real-time protocols and multicast that shall control audio over IP across DCN. Thus, the PAS solution shall be IP-based.
- 5.4.2.8 Digital announcements shall be based on real voice recording and text-to-speech engines (TTS) or a combination of both, according to the number of languages to be managed and available TTS engines.
- 5.4.2.9 The TSCC Contractor shall incorporate the following priorities as a minimum for the PAS announcement:
- Priority 1 for emergency predefined audio announcements (for example- Fire evacuation announcement).
 - Priority 2 for live local announcements from the Station
 - Priority 3 for live announcements from the OCC.
 - Priority 4 for automatic announcements triggered by the Signaling system.
 - Priority 5 for music broadcast.
- 5.4.2.10 The PAS shall support the definition of at least ten (10) different PAS announcement priorities. The priorities shall be approved by the Authority and configurable by the Operator. Priorities shall be configurable without requiring special tools or a software update.
- 5.4.2.11 Activation of a pre-recorded, automatic, or live announcement shall automatically suppress the continuous music broadcast in the corresponding zones or locations.
- 5.4.2.12 The broadcast of an announcement from the OCC to a station shall not prevent the other stations from receiving music or advertising.
- 5.4.2.13 In stations with trains passing through without stopping (independently of the type and the speed of the train), and according to stations and passenger platforms, an audible warning system, as part of the PAS, shall notify audible announcements to passengers standing on the platform of approaching trains. Also, the CIS shall alert passengers on platforms by means of displaying the proper messages in the platform PID. The messages, in English and Spanish, shall follow the local regulations. ".s should be automatically triggered to broadcast and should be ranked as priority messages. Additional station generated messages shall notify when trains shall start moving or shall open/close doors.
- 5.4.2.14 Zone and multi-zone announcements, including environmental noise sensing, shall be supported.
- 5.4.2.15 PAS broadcast zones shall be configured by a system administrator.
- 5.4.2.16 PAS zone configuration shall support any combination of single or multiple zones as may be required for safety, operations, etc.
- 5.4.2.17 The PAS zone configuration shall enable overlapping between zones for redundancy purposes.
- 5.4.2.18 Dynamic Ambient Noise Sensors (DANS) shall be used to automatically adjust the audio level in each zone at any time, including during announcements.
- 5.4.2.19 All live PAS announcements from the OCC/Depots/Stations shall be recorded in a centralized Voice Recording System (VRS) with originator identification, duration, date, and time information. Refer to the Telephony System technical specification document, which includes VRS.
- 5.4.2.20 The PA Console shall be equipped with a standard range of operational accessories to support effective use by station/control room personnel, such as "gooseneck" microphone with a Push to Talk (PTT) button, a button keyboard to select audio zones, emergency announcements, alarm tones, or music.
- 5.4.2.21 The PAS shall be able to receive, amplify, and deliver PA announcements that originate from:
- ICCS workstation at OCC and Station.



- PA console/microphone.
- Authorized telephone extensions.
- Authorized Wireless Communication System mobile devices.

- 5.4.2.22 The TSCC Contractor shall provide an acoustical coverage study, to optimize the position and the gain of the loudspeakers in all the areas.
- 5.4.2.23 An acoustic coverage study shall be submitted by the TSCC Contractor for the Authority's approval in coordination with Architectural design.
- 5.4.2.24 The Sound Pressure Level (SPL) throughout the buildings shall comply with the requirements in the current local fire code for emergency broadcasting in the event of a confirmed fire alarm.
- 5.4.2.25 The SPL throughout the buildings shall ensure the achievement of the intelligibility of the broadcasts at a minimum specified Speech Transmission Index (STI) value.
- 5.4.2.26 The PAS Graphical User Interface (GUI) on the ICSS workstation shall be capable of displaying the zone occupied during the announcements.

5.4.3 Customer Information System (CIS)

- 5.4.3.1 The Passenger Information Displays (PIDs) shall be installed at strategic locations at stations and platforms where they can be legible from a reasonable distance for an average person.
- 5.4.3.2 The PIDs shall be in areas that provide sufficient queuing and dwell space for passengers to stop and view the displays without impeding pedestrian flow or obstructing access to station entrances, fare gates, vertical transport (e.g., escalators, stairs, lifts), or other circulation-critical areas. The TSCC Contractor shall demonstrate, through pedestrian flow analysis or station circulation modelling in accordance with applicable station design standards and human factors guidelines (e.g., ISO 11064, BS EN 894, or equivalent), that the placement of each PID supports safe, accessible, and efficient passenger movement under both normal and disrupted operating conditions.
- 5.4.3.3 The CIS shall keep the passengers well informed on the travel options, and additional real-time information shall be provided as well during the disruption of the operational services.
- 5.4.3.4 The CIS shall be capable of displaying timely and location-relevant notices to passengers, including:
- Service alerts, such as delays, cancellations, and diversions;
 - Information on planned maintenance activities affecting train services or station access;
 - Emergency or unplanned disruptions, including weather-related impacts or incidents;
 - Notices about upcoming public events (e.g., festivals, sporting events) that may affect passenger volumes or travel patterns.
- 5.4.3.5 The information provided (in English and Spanish) to the passengers shall consist of the following real-time information (not limited to):
- Train number.
 - Scheduled arrival and departure time (for all trains within the next two hours).
 - Expected arrival and departure time (for all trains within the next two hours).
 - Train origin and destination.
 - All intermediate stations.
 - Platform number (including highlighting platform changes).
 - Passenger facilities on the train.
 - Name of the train operator.
 - Clock displaying current local time.



- Operational, normal, and emergency (including evacuation) messages to passengers.
- Supplementary information like temperature.
- Service alerts and disruptions, including delays, cancellations, or changes to train services due to delays, incidents, adverse weather, or planned maintenance activities.

5.4.3.6 CIS shall be designed with features which include (not limited to):

- Auto-repeat of messages.
- Cycles of messages.
- Alternated messages.
- Scheduled pre-recorded messages.
- Scrolling left / right.
- Rolling up / down.
- Flashing.
- Variable message lengths and character size.
- IP based.

5.4.3.7 The CIS shall be able to provide different types of information (not limited to):

- Pre-recorded messages and textual display messages.
- Delivery of automated scheduled messages.
- Live Operator speech.
- Infotainment.
- Advertising.
- Video streams.
- Graphics.
- Live web content.
- Multi-lingual messaging (English and Spanish languages)

5.4.3.8 Individual and predefined messages capability shall be supported by the CIS.

5.4.3.9 CIS messages shall be (not limited to):

- Predefined messages.
- Pre-formatted data completed by adding words/parameters.
- Free text messages.

5.4.3.10 The information provided to the passengers shall be clear and coherent.

5.4.3.11 The TSCC Contractor shall design a system that allows the assignment of priority levels to the different types of information broadcast, for example, a way to treat advertising, infotainment, and music as optional features with lower priority.

5.4.3.12 If an emergency evacuation is triggered or an audible alert broadcast is made, in addition to Public Address System, and to enable a fast and efficient communication to passengers and staff to assist in evacuation scenarios, PIDs within the affected voice alarm zone shall automatically fill the entire display screens with an appropriate emergency messages, giving people in the danger zone both audible and visual alerts and direction, quickening response and evacuation times. Emergency



messages shall continue to be displayed on screens even if the system's server or the IP network has failed.

- 5.4.3.13 The information (including advertisements) shall be shown in PIDs placed at least at the station entrance, concourse, ingress automatic gates, and station platforms to advise passengers.
- 5.4.3.14 Each display technology shall be appropriate for its location, application, and high performance, with due regard to environment, lighting levels, and legibility.
- 5.4.3.15 Each display on platforms and in concourses shall be fully readable to a normal sighted individual when standing or sitting in a wheelchair.
- 5.4.3.16 The PIDs shall comply with the principles of EN 16584-2:2020 – Railway Applications – Design for Accessibility, ensuring that real-time and static information is legible from typical passenger approach paths. The displays shall meet the following minimum criteria:
- Characters shall be at least 20 mm high for sighting distances of up to 8 meters and scaled proportionally for greater distances.
 - Text and symbols shall have a minimum luminance contrast ratio of 70% against the background.
 - Displays shall be positioned to avoid glare and provide visibility from multiple angles, including for users with mobility or visual impairments.
 - Information shall be bilingual (English and Spanish), clear, concise, and unambiguous.
- 5.4.3.17 All PIDs shall conform to the accessibility and visibility provisions of the ADA Standards for Transportation Facilities (49 CFR Part 37, Appendix A), including:
- Text characters used in fixed or dynamic messages shall be sans-serif, uppercase or mixed-case, and of a height appropriate to the viewing distance and ambient conditions.
 - Displays shall be mounted at a height and angle that enables clear line of sight for both standing and seated users, including persons using wheelchairs.
 - Displayed content shall provide high contrast, non-reflective backgrounds, and remain visible under lighting conditions typical to indoor and covered station environments.
 - All dynamic information must be provided audibly via the Public Address system where required, to ensure compliance with multimodal accessibility principles.
- 5.4.3.18 The CIS shall be capable of creating and displaying passenger information in any combination of characters, numerals, animated graphics, punctuation & symbols.
- 5.4.3.19 The CIS shall incorporate a real-time digital clock, which must be synchronized with the Network Timing System (NTS), and the addition of a message display.
- 5.4.3.20 The CIS digital clocks shall show local time in the 24-hour format: HH:MM: SS and configurable to show local time in AM/PM format.
- 5.4.3.21 Displays that have dates shall use US customary format – MM:DD: YY.
- 5.4.3.22 The CIS shall be able to operate in all ambient artificial lighting conditions and outdoor lighting environments, including full sunlight conditions found throughout the station, and automatically adjust the display intensity/illumination/brightness to match ambient conditions.
- 5.4.3.23 Energy-saving modes shall be implemented, including brightness adjustment, and/or switching on or off hours before trains are expected.
- 5.4.3.24 The PIDs shall be professional high-performance displays with suitable housing used for public display applications.



- 5.4.3.25 The PID housing shall be adequate for the indoor and outdoor environments, depending on the location.
- 5.4.3.26 All displays shall be equipped with a status indication arrangement that is visible outside the panel enclosure, allowing maintenance personnel to check the PID status at a glance.
- 5.4.3.27 The CIS shall automatically coordinate PAS announcements with travel information shown on PIDs across the site.
- 5.4.3.28 All messages shall be displayed in English and Spanish, and/or blinking/flipping between the two languages as selected by the CIS operator.
- 5.4.3.29 Display information shall be sourced from the centralized control system, with the capability for manual override from ICSS workstations in the OCC.
- 5.4.3.30 Each CIS layout shall be easily configurable by authorized users, allowing them to choose which blocks and widgets, such as live news and travel feeds, videos, or graphics, are displayed where on each of the display screens.
- 5.4.3.31 The authorized users shall be able to create those templates to be used by the authorized operator, depending on the needs of each display location or even operational conditions (evacuation, alarms, operational incident, etc.).
- 5.4.3.32 The CIS shall continue normal operation and dissemination of information without interruption during template change.
- 5.4.3.33 The PIDs shall support the display of a defined template in degraded mode (loss of communication). This template shall display as a minimum, the local time, a predefined message, and an appropriate image.
- 5.4.3.34 The TSCC Contractor shall provide an ergonomic study to optimize the position of the PIDs in the stations.
- 5.4.3.35 The PID screen shall be based on LED technology.
- 5.4.3.36 The minimum size for the PID screen must be 42 inches diagonal.
- 5.4.3.37 The PIDs screen resolution shall be at least 4K, with an aspect ratio according to the purpose and location of the display within the station or facility.
- 5.4.3.38 The PIDs shall be capable of displaying commonly supported media file formats (e.g. MP4, MPEG-4) but shall not allow deprecated or insecure technologies such as Flash or DVD/Blu-ray playback. All media playback systems must be integrated into a secure content management platform that prevents unauthorized access or tampering.
- 5.4.3.39 It shall be possible to monitor the status as well as the current contents of any PID at any location.
- 5.4.3.40 All PIDs shall support secure remote monitoring, diagnostics, and update functionality, including retrieval of log files, firmware version, and current content status.
- 5.4.3.41 The CIS shall provide remote operator capability to shut down or blank out any or all PIDs in the event of cyber intrusion, inappropriate content display, or failure scenarios, without impacting emergency visual messaging systems.
- 5.4.3.42 The CIS shall support open APIs (e.g., GTFS-RT, SIRI-SM) for future integration with mobile apps, web portals, and third-party passenger information services.
- 5.4.3.43 The CIS shall support future integration with AI-powered analytics systems to enhance passenger communication, disruption handling, and system resilience.

5.4.4 **PACIS Management System**

- 5.4.4.1 The PACIS Management System shall include the following features (not limited to):
 - Friendly user GUI and remote web browser interface.



- Graphical display of the PACIS associated elements along the California High-Speed-Rail system.
- The status of the PACIS equipment shall be graphically shown.
- PACIS zone and multi-zone configuration and edition.
- Creation, loading and editing of PACIS messages and templates.
- Pre-programming system triggering events.
- Alarms and status information in both graphical and table formats.
- Alarms drill-down analysis to diagnose alarm root-cause.
- Message priorities assignment and pre-emption strategy when simultaneous messages are broadcasted.
- Co-ordinating PACIS messages.
- Retrieve event logs (creation of daily/weekly/monthly/annual log files of all events).
- Modifying pre-defined system information.
- System parameter configuration.
- Report generation.

5.4.4.2 The PACIS Management System shall be provided with administration capabilities as a minimum:

- Log-on Levels Control Functions.
- System administration, management, and housekeeping functions.
- System configuration and user data modifications, including resetting of passwords.
- Read only to system configuration and use data modification.
- Creation, configuration, and deletion of users and associated roles.
- Creation and deletion of designated functions and commands available to each log-on control access level.

5.4.4.3 The PACIS Management System shall monitor system alarm status on a real-time basis and allow alarm acknowledgment, filtering, and export at least in Excel format.

5.4.4.4 The PACIS Management system shall maintain for at least 90 days a historical record archive of system faults, including fault event timestamp, fault location, fault type, and fault cleared timestamp.

5.4.4.5 In addition to the alarms and status to be shown on the ICSS workstation in the OCC, the status of major equipment of the system shall be monitored and displayed with suitable indications to the local PACIS equipment.



5.5 Performance Requirements for PACIS

5.5.1 Public Address Systems (PAS)

- 5.5.1.1 Voice announcement latency to any location from any central facility shall not exceed 250ms.
- 5.5.1.2 The amplifier switching shall be automatic, seamless, without any intervention or interruption to the ongoing audio announcement dissemination.
- 5.5.1.3 Each zone shall be equipped with a sufficient number of speakers located throughout the zone to ensure uniform audio levels
- 5.5.1.4 The coverage variance shall be within the range of ± 3 dB for the whole coverage area.
- 5.5.1.5 Loudspeakers shall not be driven at more than 80% of their maximum allowable input rating.
- 5.5.1.6 Sufficient quantities of Digital Ambient Noise Sensor (DANS) shall be installed to fully detect the ambient noise within each zone.
- 5.5.1.7 The output level of the PA audio announcement shall be adjusted in a real-time manner according to the level of noise measured by DANS.
- 5.5.1.8 The PAS shall ensure that the broadcast sound level provided as necessary throughout the dedicated area is greater than the ambient noise level by a configurable value (typically 10dB) up to a maximum of 95dBA.
- 5.5.1.9 The PAS volume distribution at distances beyond 50 meters from the ROW (Right-of-Way) shall not exceed 65 dBA. During nighttime, in residential areas, the volume level shall be reduced by an additional 10 dBA. The TSCC Contractor shall verify that system specifications comply with all local noise regulations.
- 5.5.1.10 The reverberation time (RT60) at 500Hz shall be less than 1.5 seconds (Max RT).
- 5.5.1.11 The PAS shall provide STI > 0.5.
- 5.5.1.12 The TSCC Contractor shall perform acoustic testing to ensure audio performance of the PA system in each zone according to the latest revision of standard IEC 60268-16.
- 5.5.1.13 The PAS shall allow the operator to adjust manually the volume level, and automatic volume control shall not override the manual adjustment made unless further configuration setting is edited.
- 5.5.1.14 At the California High-Speed-Rail facilities, the distribution of the audio signals and cable route design shall be configured in redundant approach to ensure that failure of an amplifier, a cable and/or a speaker does not render the PA system inoperative or result in the total loss of PA facility in any part of any zone.

5.5.2 Customer Information System (CIS)

- 5.5.2.1 The PIDs shall use LED screen monitors with video display capability with a size and resolution consistent with viewing from a distance up to 25 meters and from the viewing angle of +/- 160 degrees or better from the horizontal and from the vertical.
- 5.5.2.2 PIDs shall be sized to show individual station names or words of messages. Each station's name, or words of messages, shall be displayed for a minimum of 2 seconds.
- 5.5.2.3 If scrolling information is shown (either horizontal or vertical), each complete word shall be displayed for a minimum of 2 seconds, and the horizontal scrolling speed shall not exceed 6 characters per second.
- 5.5.2.4 The time between the validation of any operator action in real time and the reception of it into PIDs shall not exceed 3 seconds.



5.5.3 Safety Requirements

- 5.5.3.1 PACIS shall comply with the safety requirements defined in Schedule 1 and the Authority's System Safety Plan.
- 5.5.3.2 Where PACIS supports evacuation, emergency messaging, or audible warning, these functions shall be assigned a minimum Safety Integrity Level (SIL) 1 as per EN 50126-2.

5.5.4 RAM Requirements

- 5.5.4.1 The TSCC Contractor shall be responsible for performing all the activities as specified in Schedule 1 and the Authority's RAM Management Plan.

5.6 Cybersecurity and Security Requirements

- 5.6.1 The PACIS design, configuration, and operation shall be fully compliant with the California HSR Cybersecurity Technical Specification. All generic security controls, roles, logging, patching cadence, incident-response procedures, and assurance measures are established within the California HSR Cybersecurity Technical Specification.
- 5.6.2 All PACIS components, including PIDs, PA controllers, servers, and media players, shall be treated as networked endpoints and subject to the Authority's cybersecurity compliance reviews, threat modeling, and supply chain risk assessments.
- 5.6.3 The TSCC Contractor shall ensure that all display and multimedia content sources are verified, approved, and distributed through a secure content management platform with appropriate user access controls and content validation mechanisms, including the usage of cryptographic hashes to verify the integrity of media files. Use of deprecated or insecure file formats (e.g., Flash, DVD media, or unauthorized codecs) is prohibited.
- 5.6.4 The PACIS network topology shall implement segmentation and security zoning such that a local compromise (e.g., ransomware attack) cannot propagate to other zones or affect other systems. Each system shall be capable of being logically or physically isolated without interrupting emergency override functions.
- 5.6.5 Controls shall be implemented to prevent and mitigate the potential for unauthorized messages to be displayed on any passenger facing visual displays.
- 5.6.6 PACIS and associated systems shall have a nominated System Owner who shall be accountable for cybersecurity risk ownership and mitigation.



6 INTERFACES REQUIREMENTS

6.1 General Requirements

6.1.1 The interfaces are classified as following:

- 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: 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.

6.2 Third Party Interface

6.2.1 Interfaces between PACIS from and to any external database or external transport mode real-time traffic information should be aligned with and based on the General Transit Feed Specification (GTFS) format, or a similar format agreed with the Authority. In addition, other related standards and specifications to ensure future interoperability between external information systems through open interfaces.

6.2.2 For the implementation of those open interfaces, the TSCC Contractor shall ensure (not limited to) that adequate APIs are used or developed (e.g., SIRI-SM API for exchanging real-time information about public transportation services), the needed models are implemented, and a common codification is adopted. Moreover, integration tests shall be conducted to ensure the full interoperability of the information exchange between transport operators' information systems.

6.3 External Interfaces - Trainsets

6.3.1 The TSCC Contractor shall work together with the Trainset contractor to allow OCC to make live audio announcements and display videos/messages via the Future Railway Mobile Communication System (FRMCS) to the Rolling Stock onboard public address and passenger information display system(s).

6.4 External Interfaces – facilities contractor

6.4.1 The TSCC Contractor shall install all PACIS equipment in the OCC and facilities being provided by the facilities contractor.

6.4.2 Visible equipment shall be integrated harmoniously with the architecture of the stations.

6.4.3 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



- 6.4.4 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

6.5 External Interfaces – stations contractor

- 6.5.1 The TSCC Contractor shall install all PACIS equipment in the stations.
- 6.5.2 Visible equipment shall be integrated harmoniously with the architecture of the stations.
- 6.5.3 The TSCC Contractor shall provide to the station contractors:
- 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
- 6.5.4 To be provided by stations contractor to accommodate the TCSS equipment installation and operational/maintenance requirements:
- Stations layouts
 - Room dimensions and layouts
 - Room facilities (Plumbing, HVAC, Lighting, Fire Protection Systems, Doors, electricity)
 - Room raised floor system
 - Delivery access routes.
 - Maintenance access routes

6.6 Internal Interfaces

6.6.1 Interface with Digital Communications Network (DCN)

- 6.6.1.1 The PACIS shall have an interface with the DCN for the transport of PACIS data in a secure and reliable way and the interconnection of all PACIS devices along the California High-Speed-Rail System.

6.6.2 Interface with Traffic Management System (TMS)

- 6.6.2.1 The PACIS shall have an interface with the TMS for real-time traffic information display, such as train identification, change of time, cancellation, mission/itinerary modification, and, in general, provide all required information to PACIS to ensure the functionalities and performance described in this specification for PACIS.



6.6.3 Interface with Telephony System

- 6.6.3.1 The PACIS shall have an interface with the Telephony System to allow announcements from authorized telephones to the PAS.
- 6.6.3.2 The PACIS shall have an interface with the Voice Recording System as a part of the Telephony System, to record all the live announcements made through the PAS.

6.6.4 Interface with Network Timing System (NTS)

- 6.6.4.1 The PACIS shall have an interface with the NTS to ensure an accurate current time of the day display and to provide time synchronization to the PACIS system.

6.6.5 Interface with Integrated Control and Supervision System (ICSS)

- 6.6.5.1 The PACIS shall interface with the ICSS to manage PAS and PIS audio announcements and visual messages from ICCS HMI.
- 6.6.5.2 The PACIS shall have an interface with the ICSS on standard protocols, e.g., SNMP (no vendor proprietary protocols shall be used), to allow status monitoring of the PACIS equipment.

6.6.6 Interface with Enterprise Asset Management System (EAMS)

- 6.6.6.1 The PACIS shall provide static Asset Information and dynamic Asset Information to the EAMS for maintenance activities and asset lifecycle management activities.

6.6.7 Interface with Wireless Communication System (WCS)

- 6.6.7.1 The PACIS shall have an interface with the FRMCS System (Future Railway Mobile Communication System) to allow OCC personnel to make announcements and distribute visual messages via the PACIS system on any Trainset or selected group of Trainsets.
- 6.6.7.2 PAS shall interface with FRMCS to allow live audio announcements from authorized FRMCS devices.
- 6.6.7.3 The PACIS shall interface with the Fire Alarm and Protection System to provide automatic announcements in emergency situations. The local Fire Alarm and Protection System at the station shall be directly connected to one of the station's PACIS elements to broadcast emergency pre-recorded audio announcements through PAS loudspeakers.

6.6.8 Interface with Low Voltage Power System (LVPS)

- 6.6.8.1 The PACIS shall have a redundant interface with the LVPS to ensure an uninterruptible power supply with battery backup of minimum 12 hours..



7 MATERIALS, PRODUCT AND COMPONENTS REQUIREMENTS

7.1 General Requirements

- 7.1.1 All materials supplied by the TSCC Contractor 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.

7.2 Software and Hardware Requirements

- 7.2.1 The PACIS design shall be based on COTS (Commercial Off-The-Shelf), open architecture, and modular system architecture, with standard non-proprietary interfaces.
- 7.2.2 The TSCC Contractor's design for central servers shall be on-premises, either physical, virtualized, or cloud, to ease systems evolution, complying with the Cybersecurity requirements defined in Cybersecurity Technical Specifications.
- 7.2.3 All cabling for PACIS shall be designed, supplied, installed, and commissioned by the TSCC Contractor.
- 7.2.4 The displays and speakers shall be maintenance-free.
- 7.2.5 PA loudspeakers located in external zones shall be compliant with IP66.
- 7.2.6 PACIS should adopt networked IP-based devices with PoE-type power supply, if possible, as soon as transmission distances allow it (typically less than 100m), i.e., in the presence of nearby network switches and according to the consumption of the devices. For longer distances, other technologies, such as Powered Fiber Cable systems, should be used to avoid the need for extra power-feeding cables and devices.
- 7.2.7 The PACIS servers/controllers shall have a redundant power supply.
- 7.2.8 The PACIS devices shall be connected to the UPS of the facility where they are located (OCC, station, etc.).
- 7.2.9 To simplify the PAS architecture, loudspeakers with built-in amplifiers can be considered for some locations.
- 7.2.10 The PIDs with at least 4K resolution displays shall be used due to their flexibility for passenger information purposes, video, infotainment, etc., by means of the possibility of defining multiple blocks or widgets within the screen area. Any other approach by the TSCC Contractor shall be properly justified, ensuring that a greater level of functionality, greater flexibility, reduced lifecycle cost, improved sustainability, etc., is provided.
- 7.2.11 The PIDs shall allow future extension and upgrading of native capabilities for display and management of graphics, animations, and digital video files playback.
- 7.2.12 PIDs shall be IP-based.
- 7.2.13 Low toxicity, low smoke emission, low flammability, zero halogen fire retardant cable shall be used for the distribution of broadcast signals to the speakers and signals to the displays.
- 7.2.14 Power consumption for each PACIS component type (PID, speaker, controller) shall be specified. Total system energy estimates shall be provided for normal, degraded, and standby modes.

7.3 EMC Requirements

- 7.3.1 The PACIS 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 equivalent)



8 TOLERANCES

Not applicable to PACIS.



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 PACIS system scope of work.

9.2 Specific Requirements

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

- Central and local servers.
- Displays.
- Speakers.
- PA console.
- DANC.
- Controllers.
- Amplifiers.
- Cabling and connectors.
- Racks.
- Software architecture, including a full definition of protocols used.
- Management System.
- HW/SW licenses.
- Auxiliary elements and gear (cases, bird repellent spikes, attachments, bindings, testing equipment, etc.).
- Spare parts.



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 testing and acceptance requirements are defined in the Scope of Work and Schedule 3.

12.2 Specific Requirements

12.2.1 General test cases, Interface test cases, and the following information (not limited to) shall be recorded and reported during the test procedure:

- For commercial advertisement purposes, the CIS display scheduling template and content shall be tested in accordance with the configurable time duration, subject to approval from the Authority.
- Real-time information received from the train control system, its dissemination on PACIS equipment, e.g., destination, train arrival/departure, train passing through, etc. The test shall also be done by the actual operation of running trains on the mainline.
- Noise sensing and automatic gain control function by DANS.
- Emergency evacuation triggering test, display, and audible alert broadcasts made on PACIS equipment.

12.2.2 Functional test cases shall be defined to validate PACIS performance under degraded communications, server failover, emergency overrides, content switching delays, and alarm prioritization.

12.2.3 CIS template override scenarios and fail-safe displays (e.g., static message + time) shall be tested for network loss and emergency activation cases.



13 SUBMITTALS

13.1 General Requirements

13.1.1 General submittal requirements are defined 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 PACIS subsystem reliability, availability, and maintainability characteristics.



16 LOGISTICS

16.1 General Requirements

16.1.1 General logistics requirements are defined in the Agreement.

