



SECTION 27 21 33 - WIRELESS COMMUNICATION SYSTEM – Wi-Fi

PART 1 - GENERAL

1.1 SUMMARY

- A. See IT Infrastructure Standards of Practice Volume 2, Chapters 1 and 2 for infrastructure requirements.
- B. LAWA contractors, LAWA tenants and their contractors shall include in the construction submittal all necessary details about the proposed installation, including equipment, Wi-Fi coverage projection, network connections, Wi-Fi access point (AP) installation, IT rooms to be accessed/used, and estimated cost/installation duration.
- C. LAWA contractors, LAWA tenants and their contractors are responsible for providing and coordinating final equipment arrangements, locations, phased activities and construction methods that minimize disruption to airport/terminal operations in providing complete and operational Wi-Fi systems.
- D. LAWA contractors, LAWA tenants and/or their contractors shall coordinate with LAWA for provision of horizontal conduit and field boxes required to accommodate cabling of all Wi-Fi access points and other system equipment.
- E. Due to space and power constraints in LAWA facilities, LAWA will provide all Wi-Fi required by Tenant at the sole expense of the Tenant. Tenant shall design Wi-Fi per LAWA Wi-Fi standards (see Part 2 of this specification) using LAWA Wi-Fi system standard equipment and materials. Proposed Tenant Wi-Fi design shall be reviewed and approved by LAWA prior to construction start. Tenant is responsible to connect all Wi-Fi APs to LAWA patch panels in LAWA Telecommunication Room (TR) and further connect from LAWA patch panels to LAWA standard network switches. Tenant design shall be sent for review to LAWA Office of Infrastructure Technology, 6053 W. Century Blvd., Suite 200, Los Angeles, CA 90045, Attention: Wi-Fi Review.
- F. Required network switches for new APs shall be purchased by Tenant from LAWA's current network equipment provider and shall be purchase with one (1) year of Cisco SmartNet next business day maintenance. Tenant shall perform all installation of all equipment and cabling required. Network switches shall be configured by LAWA. The network switches shall become property of LAWA after installation and will be managed/maintained by LAWA. LAWA will have full control over broadcasting SSIDs and setting transmission frequencies and channels.
- G. LAWA will provide an operational SSID for tenant use. Tenant shall provide a RADIUS server IP address to which LAWA will direct operational traffic. Tenant clients must be capable of supporting WPA2 Enterprise (802.1x). Tenant shall connect to designated LAWA demarcation point in nearest LAWA TR on a LAWA patch panel positions assigned by LAWA.
- H. Every four (4) years (or earlier by mutual agreement of LAWA and the Tenant), the Wi-Fi APs will need to be upgraded to support the latest technology.
- I. Related documents within the LAWA Design and Construction Handbook: Section 27 05 00 – Basic Telecommunication Requirements



1.2 REFERENCES

- A. Glossary
1. ANSI - American National Standards Institute
 2. AP - Access Point (wireless receive and transmit antenna)
 3. ASTM - American Society for Testing Materials
 4. BFU - Board of Fire Underwriters
 5. BICSI - Building Industry Consulting Services International
 6. CSA - Canadian Standards Association
 7. DEC - Department of Environmental Conservation
 8. EIA - Electronics Industry Association
 9. ER - Equipment Room
 10. FCC - Federal Communications Commission
 11. FM - Factory Mutual
 12. IEEE - Institute of Electrical and Electronics Engineers
 13. ISO - International Standards Organization
 14. NEC - National Electrical Code
 15. NEMA - National Electrical Manufacturers' Association
 16. NESC - National Electrical Safety Code
 17. NFPA - National Fire Protection Association
 18. OSHA - Occupational Safety and Health Administration
 19. TIA - Telecommunications Industry Association
 20. TR - Telecommunications Room
 21. TWC - Tenant Wiring Closet
 22. UFBC - Uniform Fire Prevention and Building Code
 23. UL - Underwriter's Laboratories, Inc.
 24. SSID – Wi-Fi Service Set Identification, also known as a Wi-Fi network name
 25. WPA2 – Wi-Fi Protected Access II protocol
 26. RSSI - Received Signal Strength Indication
 27. AEGIS - LAWA Airport Engineering Geographical Information System (also known as LUSAD – LAWA Utility Survey and Drawing System)
 28. DHCP - Dynamic Host Configuration Protocol, a standardized network protocol for computer servers or network controller to allocate IP addresses to computer network devices
- B. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of the telecommunications industry, as well as



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federal, state and local governmental agencies, including, but not limited to the following references:

1. IEEE 802.11 (a, b/g, n, ac) - Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
 2. ANSI/TIA/EIA-568-C.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements, 02/02/09
 3. ANSI/TIA/EIA -569-B Commercial Building Standard for Telecommunications Pathways and Spaces, May 2009
 4. ANSI/TIA/EIA -606-A Administration Standard for Commercial Telecommunications Infrastructure, 11/24/08
 5. ANSI/TIA/EIA -607 Commercial Building Grounding and Bonding Requirements for Telecommunications, August 1994
 6. ANSI/TIA/EIA - 862 Building Automation Systems Cabling Standard for Commercial Buildings, 2002
 7. FCC 47 Part 68 Code of Federal Regulations, Title 47, Telecommunications
 8. IEEE National Electrical Safety Code (NESC); 2007
 9. ISO/IEC 11801 Information Technology - Generic Cabling For Customer Premises
 10. LADBS - Los Angeles Department of Building and Safety - City of Los Angeles Electrical Code
 11. NEMA 250 - Enclosures for Electrical Equipment (1000 V Maximum)
 12. NFPA-70 - National Electric Code; 2008
 13. UL 1863 - Underwriters Laboratories Standard for Safety – Communications Circuit
 14. Accessories
- C. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these specifications.

1.3 SUBMITTALS

A. General

Comply with all LAWA submittal procedures given in other Sections. The following is in addition to or complementary to any requirements given elsewhere. Every submittal at 5% to 100% shall be in both hard copy and digital formats. All digital documentation shall be in one of the following file formats: Drawings should be in Autodesk DWG; Documentation should be in Microsoft Word; Spreadsheets should be in Microsoft Excel, etc. Plan view drawings shall be referenced and scaled to NAD83 and NAVD 88. PDF versions of all submitted documents shall also be provided.

B. Action Submittals

1. Submit an initial request to LAWA for Wi-Fi service with the following information:
 - a. A to-scale plan view drawing showing approximate desired coverage area and a call out indicating the square footage



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- b. Proposed number of Access Points (APs) to be installed
 - c. Estimated average and maximum number of wireless users
 - d. Method of user authentication shall be WPA2 Enterprise, 802.1x
2. Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities.
 3. Submit all proposed labeling materials and nomenclature.
 4. Coordination Drawings:
 - a. Indicate locations where space is limited for installation and access.
 - b. Submit floor plans, elevations, and details indicating major equipment and end device locations. Indicate all floor, wall and ceiling penetrations.
 5. Submit details of proposed Wi-Fi system, access point locations (refer to paragraph 3.4), bandwidth(s) and other details to LAWA for approval and coordination with other existing Wi-Fi systems and applicable LAWA wireless usage agreements and procedures.
 6. Submit floor plans with heat maps overlaid that show the results of contractor's Wi-Fi vendor's predicative analysis modeling to indicate areas of coverage and extrapolated signal strength.
 7. Submit all testing plans (acceptance and endurance) for review and approval prior to the performance of any test.
 8. Submit a single line diagram depicting the tenant-to-LAWA interconnection as well as tenant to ISP (internet service provider) connection.
- C. Closeout Submittals – If the construction of the proposed Wi-Fi system is approved and the system is installed, tenants and their contractors must submit to LAWA as-built system drawings for record. The drawings shall be in current AutoCAD DWG and Adobe PDF format and shall include:
1. Marked-up copies of Contract Drawings
 2. Marked-up copies of Shop Drawings
 3. Newly prepared Drawings
 4. Marked-up copies of Specifications, Addenda and Change Orders
 5. Marked-up Project Data submittals
 6. Record Samples
 7. Field records for variable and concealed conditions
 8. Record information on work that is recorded only schematically
 9. As-built drawings with indication of LAWA assigned AP name & its MAC address
 10. Record drawings
 11. All AP's labeled on outside with IT tags visible from floor
 12. Operation and maintenance manuals
 13. Electronic As-built – All electronic as-built drawings covering the above, wherever applicable, shall be submitted to LAWA at the conclusion of the construction to be



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included as a part of the AEGIS repository and its Autodesk Map repository. All drawings shall be in vector format.

14. Wireless Riser Diagram

1.4 QUALITY ASSURANCE

- A. The Contractor shall conduct a visual inspection of all installations to verify that the installations are in accordance with the LAWA’s permit and manufacturer's specifications. Records of the inspections signed and dated by the Contractor shall be included as a part of the Closeout Submittals to LAWA. LAWA may elect to participate in any inspection(s). All QC information shall be provided to LAWA for input into the CMMS (refer to paragraph 3.9).

1.5 APPROVED EQUIPMENT & SUBSTITUTION

All equipment, parts and materials provided under a contract with LAWA must be new, unused, in manufacturer boxes with manufacturer seals intact, shipped direct from the manufacturer to LAWA, and registered to:

Los Angeles World Airports
 IMTG – Office of Infrastructure Technology
 6053 W. Century Blvd, Suite 200
 Los Angeles, CA 90045

No refurbished, rebuilt, or grey market items shall be allowed at any time.

All items must be installed by manufacturer approved personnel using manufacturer approved materials, tooling, equipment, and protocols/procedures.

- A. Current LAWA approved Wi-Fi equipment (as of June 20, 2017) is listed below. All Wi-Fi equipment is standardized on Cisco devices. Verify for the latest models supported by LAWA within 6 months of installation.

<u>Model Name / Number</u>	<u>Remarks</u>
AIR-CAP1572I-A-K9	Outdoor Access Points
AIR-CAP1572E Series	Outdoor Access Points w/ External Antenna
AIR-CAP3802E-A-K9	Indoor Access Points with External Antenna
AIR-CAP3802I-A-K9	Indoor Access Points with Built-In Antenna
Recessed mount kit for indoor AP	To flush mount into buildings’ ceiling
AIR-ANT-LOC-01	Hyperlocation Antenna, Model 1
AIR-RM3010L-B-K9	Hyperlocation Module
WS-C3850-xxU-PoE	Wi-Fi Controller/Switch
WLC-5520 or 2504*	Wi-Fi Controller with Code 8.2.x or later
AP & PI License	Required for each Access Point

*Anchor controller

Approval of alternate or substitute equipment or material in no way voids specification requirements.

- B. LAWA Contractors, LAWA tenants, and tenant contractors who are performing the construction of Wi-Fi system/equipment at LAWA airports must contact LAWA Office of IT Infrastructure Technology to verify the latest approved LAWA Wi-Fi equipment list.



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- C. Any substitution from the approved Wi-Fi equipment list must receive LAWA Infrastructure Division's approval. Approval of alternate or substitute equipment or material shall in no way void other Specification requirement set forth in this document.
- D. Under no circumstances shall LAWA be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submits to LAWA all evidence to support the contention that the item proposed for substitution is equal to the specified item. LAWA's decision as to the equality of substitution shall be final and without further recourse.

1.6 EQUIPMENT CERTIFICATION

- A. Provide materials that meet the following minimum requirements:
 - 1. Electrical equipment and systems shall meet UL Standards (or equivalent) and requirements of the NEC. Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.
 - 2. Equipment shall meet all applicable FCC Regulations.
 - 3. All equipment and systems must conform to the Specifications.
 - 4. Where applicable, all materials and equipment shall bear the label and listing of Underwriters Laboratory or Factory Mutual. Application and installation of all equipment and materials shall be in accordance with such labeling and listing.
- B. Components of equipment shall bear the manufacturer's name or trademark, model number and serial number on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- C. Major items of equipment that serve the same function must be the same make and model.
- D. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.
- E. Maximum standardization of components shall be provided to reduce spare part requirements.

1.7 FIELD/SITE CONDITIONS

- A. The Contractor shall be responsible for the proper placement of all cabling, racks, cabinets, patch panels, cover plates, outlet boxes, and related hardware, as well as all distribution, and termination equipment.
- B. The Contractor shall obtain the approval of LAWA for the final layout of any equipment to be installed in new or existing telecommunications rooms and tenant wiring closets prior to the installation of any materials or equipment. Shop drawings showing proposed installation details shall be submitted for approval before beginning installation.
- C. The Contractor shall furnish an adequate supply of technicians and materials at all times, and shall perform the work in the most appropriate, expeditious, and economical manner consistent with the interests of the LAWA.
- D. The Contractor shall be responsible to LAWA for the acts and omissions of its employees, subcontractors and their agents and employees, and other persons performing any of the work under a contract with the Contractor.
- E. The Contractor shall not unreasonably encumber the site with any material or equipment. Construction, installation and operations shall be confined to areas permitted by law, permits, and contract documents.



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- F. The Contractor shall have an experienced Project Manager on site at all times when work is in progress on any project. The individual who represents the Contractor shall be the single point of contact between the Contractor and LAWA, and shall be responsible for the entire project. This representative shall be able to communicate with LAWA or designated representative whenever requested throughout the life of the project.
- G. While working in the facility, the Contractor shall not block any entrances, egresses, or other passageways that are necessary for normal and safe operation. It should be noted that the Contractor is responsible to provide any lifts, hand trucks, etc. that it will need to transport its materials and equipment throughout the site.
- H. The Contractor shall protect all buildings, walls, floors, and property from damage resulting from the installation. Any and all damage to property shall be repaired by the Contractor at its expense. If the Contractor enters an area that has damage (not caused by the Contractor), the Contractor shall immediately bring this to the attention of LAWA so the area can be appropriately noted.
- I. Following each day's work, the Contractor shall clean up the areas in which it has been working and dump all trash in the appropriate designated areas.
- J. The Contractor shall notify LAWA of any existing facility shutdowns through LAWA's USR (Utility Shutdown Request) and ASR (Area Shutdown Request) process when working in the airport terminals.

PART 2 - LAWA PASSENGER TERMINAL ABBREVIATED WI-FI DESIGN STANDARD

2.1 GENERAL

- A. Standard Used: IEEE 802.11ac
- B. Bandwidth Minimums: 75 Mbps download and 25 Mbps upload
- C. Three Density Classifications within Passenger Terminals: Ultra High, High, Medium, Low
- D. Signal Strength Requirements (RSSI): Ultra High Density at -60 dBm, High Density at -65 dBm, Medium Density at -67 dBm, and Low Density at -70 dBm
- E. Designer must consider the floorplan corners and peripheral wall boundaries within the leasehold as a starting point for AP layout design
- F. Designer must submit 30%, 60%, 90% and 100% DWG and PDF electronic design files for LAWA's review and approval
- G. Designer shall work with LAWA staff to use the BOX file hosting service to make files available for LAWA

2.2 ULTRA HIGH DENSITY DEFINITION

- A. Passenger Hold Rooms, TSA Screening Lanes/Areas
- B. One (1) hand-held device for every six (6) square feet
- C. AP Cell Size: \cong 30 foot diameter circle
- D. AP Cell Coverage: \cong 700 square feet
- E. AP Spacing: \cong 30 feet



2.3 HIGH DENSITY DEFINITION

- A. Departure Level Concourse, Concession Areas, VIP Lounges, FIS Screening Lanes/Areas
- B. One (1) hand-held device for every nine (9) square feet
- C. AP Cell Size: \cong 40 foot diameter circle
- D. AP Cell Coverage: \cong 1,257 square feet
- E. AP Spacing: \cong 40 feet

2.4 MEDIUM DENSITY DEFINITION

- A. Ticketing Areas, Baggage Carousel Arrival Areas, Federal Inspection Service Offices/Areas, Concourses, Front of Terminal Upper and Lower Levels, Ramp Baggage Makeup Areas
- B. One (1) hand-held device for every sixteen (16) square feet
- C. AP Cell Size: \cong 50 foot diameter circle
- D. AP Cell Coverage: \cong 1,964 square feet
- E. AP Spacing: \cong 50 feet

2.5 LOW DENSITY DEFINITION

- A. Tenant Spaces, Ramp Tarmac Jet Bridges, Parking Structures, Electrical Rooms, Mechanical Rooms, IT Rooms, Paging Rooms, Maintenance Offices and Areas.
- B. One (1) hand-held device for every twenty-five (25) square feet
- C. AP Cell Size: \cong 70 foot diameter circle
- D. AP Cell Coverage: \cong 3,849 square feet
- E. AP Spacing: \cong 70 feet

PART 3 - Wi-Fi SYSTEM & INSTALLATION

3.1 TENANT Wi-Fi SYSTEM GUIDELINES

All Tenant required Wi-Fi shall be installed by the Tenant at its sole cost in accordance with LAWA standards, shall be connected to LAWA's network switches and shall be managed/maintained by LAWA. Tenant shall purchase any needed hardware, software and licenses required by LAWA to provide Tenant with requested Wi-Fi service. LAWA will provide Tenant with an SSID to connect to that uses their RADIUS server to handle authentication and authorization (e.g. user name and password). The LAWA Wi-Fi system will be configured using service provider MPLS technology to help ensuring cyber security.

- A. The Tenant who plans to install Wi-Fi system and equipment in its leased areas must adhere to the following LAWA guidelines:
 - 1. The Tenant shall plan and design their Wi-Fi access point (AP) distribution within the confine of the Tenant's lease area.
 - 2. Tenant shall wire each AP to the LAWA patch panel in the nearest LAWA TR and then from the patch panel to the LAWA standard network switch in the same TR. All



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- equipment, cabling and patch panels required to create a fully functional Wi-Fi system shall be designed and installed by the Tenant.
3. The Tenant, as a part of the construction request, shall submit the Wi-Fi system and AP distribution design to LAWA Office of IT Infrastructure Technology for approval. In the interest of mitigating wireless interference between various Wi-Fi systems, LAWA Office of IT Infrastructure Technology reserves the right to work with the Tenant and its Contractor in modifying the design.
 4. The Tenant shall submit the plan and design with installation details, including proposed physical locations of all devices, in AutoCAD (.dwg) format. The submitted plan and design shall also include parts list. PDFs of AutoCAD drawings shall also be submitted.
 5. LAWA's Wi-Fi system and equipment standard is Cisco. The Tenant and its Contractor shall plan, design, purchase and install only LAWA authorized Cisco Wi-Fi systems and equipment. During the planning stage, the Tenant and its Contractors are required to contact LAWA Office of IT Infrastructure Technology to receive the current approved Wi-Fi equipment list.
 6. LAWA's communications network cabling standard is currently set to single mode fiber optic and CAT 6A copper communications cables. The Tenant and its Contractor shall plan, design, purchase and install its wiring part of the system with single mode fiber optic and CAT 6A copper communications cables, wherever applicable.
 7. The Tenant shall be responsible for the purchase/installation of all the APs, associated licenses and the Layer 2 switches required by LAWA to provide Tenant with Wi-Fi service. These switches shall be managed by LAWA Office of IT Infrastructure Technology.
 8. These APs shall be registered with LAWA Wi-Fi controller(s). LAWA Office of IT Infrastructure Technology will configure SSID's for Tenant use.
 9. The tenant is responsible for installing network cables for the network devices mentioned in above.
 10. Tenant Wi-Fi equipment and infrastructure, once installed shall become LAWA owned.
 11. The tenant Wi-Fi system traffic will be transported to the Tenant's router (within the Tenant's leased space) through the LAWA MPLS network infrastructure.
 12. The Tenant is responsible to provision and provide its own Internet service and associated router. LAWA will assign Tenant a portion of Private Address space and will use that address space to route all Tenant operational traffic to the Tenant router. The tenant shall coordinate with LAWA Office of IT Infrastructure Technology to extend its Internet service provider's demarcation from the main telecommunications room (commonly known as MPOE – minimum point of entry) to the tenant's leased area where the network router is located. The tenant shall provide DHCP service and authentication to its wireless clients.
 13. All wiring for the Wi-Fi system must be installed in conduit. The Tenant and its Contractor shall provide electrical conduit and cables for the necessary work.
- B. LAWA Office of IT Infrastructure Technology can provide guidance on implementing the above upon request.



3.2 Wi-Fi EQUIPMENT GENERAL SPECIFICATIONS

- A. Wi-Fi Access Points and Other Network Equipment
 - 1. All APs shall be current approved Cisco equipment per LAWA list (See Section 1.5 A).
 - 2. All network switch shall be Cisco equipment such as Cisco Catalyst 3850-XXU-PoE or later.
 - 3. All network routers shall be Cisco equipment.
- B. This section (Section 3.2B) applies to LAWA Contractors only.
 - 1. Provide a minimum of -65 dBm RSSI at the following locations:
 - a. Curbside areas
 - b. Ticketing check-in and ATO office spaces
 - c. Tenant and concessions areas
 - d. Concourses and holdrooms
 - e. Jet Bridge/Ramp areas
 - f. Inbound and outbound baggage makeup areas
 - 2. Provide a minimum of -70 dBm RSSI at the following locations:
 - a. Paging rooms
 - b. Mechanical rooms
 - c. Air conditioning (HVAC) rooms
 - d. IT communications rooms
 - e. Electrical rooms
 - f. LAWA shops
 - g. All basement areas (where cell phone signal cannot be accessed due to thick walls)

3.3 LABELS AND NAMING OF ACCESS POINTS

- A. Labels shall meet the legibility, defacement, exposure and adhesive requirements of UL969. Labels shall be pre-printed or laser printed type.
- B. Wherever used for cable marking, a label with a vinyl substrate and white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable shall be provided. The label color shall be different than that of the cable to which it is attached.
- C. Where insert type labels are used, provide clear plastic cover over label.
- D. Acceptable manufacturers for labels:
 - 1. W.H. Brady
 - 2. Ideal
 - 3. Panduit
 - 4. Others equal to the above
- E. This section applies to LAWA contractors only.

For Access Point (AP), the label shall be placed on the top surface of the AP where it is visible for Wi-Fi technician to spot it from the ground level. The AP shall also require the Asset Tag number, attached at the bottom of the AP which can be obtained from LAWA IMTG – Office of Infrastructure Technology.



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For Wi-Fi Controller Access Point naming and AP labeling format, as well as the Asset Tag number, contact LAWA IMTG – Office of Infrastructure Technology for further information.

- F. This section applies to LAWA contractors only.

Network switch port description: Each AP shall be named on the switch as the same format of the AP name in the Wi-Fi controller. (Note: use the Cisco Discovery Protocol command to find the actual AP name and paste it to the switch port description.

- G. See IT Infrastructure Standards of Practice, Volume 3, Chapter 1 for additional general requirements and/or other specific requirements.

3.4 FIRESTOPPING MATERIALS

- A. Fire stopping for openings through fire-rated and smoke-rated walls and floor assemblies shall be listed or classified by an approved independent testing laboratory for "Through-Penetration Fire Stop Systems." The system shall meet the requirements of "Fire Tests of Through-Penetration Fire Stops" designated ASTM E814.
- B. Inside of all conduits, the fire stop system shall consist of dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required). The sealant must be capable of being removed and reinstalled and must adhere to all penetrants and common construction materials and shall be capable of allowing normal wire/cable movement without being displaced.

PART 4 - EXECUTION

4.1 GENERAL

- A. System installation and construction methods shall conform to LAWA requirements, requirements of the State of California and all applicable building codes.
- B. Before construction work commences, the Contractor shall visit the site and identify the exact routing for all horizontal and backbone pathways.
- C. The Contractor shall install equipment to meet Seismic Zone 4 requirements of the State of California and as stated herein.
1. Where undefined by codes and standards, Contractor shall apply a safety factor of at least 2 times the rated load to all fastenings and supports of system components.
- D. All equipment locations shall be coordinated with other trades and existing conditions. Coordinate work with other trades and existing conditions to verify exact routing of all cable conduit, etc. before installation. Coordinate with all the Telecommunications, Mechanical, Baggage Handling and Electrical Drawings. Verify with LAWA the exact location and mounting height of all equipment in finished areas.
- E. All work shall be concealed above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, LAWA shall be notified before starting that part of the work. In areas with no ceilings, install only after LAWA reviews and comments on arrangement and appearance.
- F. The Contractor shall patch all openings remaining around and inside all conduit, sleeves and cable penetrations to maintain the integrity of any fire rated wall, ceiling, floor, etc. The fire stop system shall consist of a dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming materials (where required). The sealant must be capable of being removed and reinstalled and must adhere to all



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- penetrants and common construction materials and shall be capable of allowing normal wire/cable movement without being displaced.
- G. Provide required supports, beams, angles, hangers, rods, bases, braces, straps, struts, and other items to properly support work. Supports shall meet the approval of LAWA.
 - H. Cable Dressing: Where fiber or copper cables enter telecommunications room it shall be neatly bundled and fastened and a suitable transition device installed to minimize tension and bend radius on cables. All cable runs shall be horizontal or vertical, and bends shall comply with minimum specified cable bending radii.
 - 1. Cables shall be combed and each strand shall run parallel with the other strands.
 - 2. After combing and straightening strands, Contractor shall separate strands into bundles according to routing requirements and termination points.
 - 3. Bundles shall be secured with hook-and-loop cable strap material.
 - a. Cable ties manufactured from a hard polymer material, such as plastic or nylon, shall not be used.
 - b. Hook-and-loop material shall be low life cycle, back-to-back type, black in color, and ½ inches wide.
 - 4. Contractor shall begin to bundle and strap cables within 6 inches of exit from conduit, and bundles shall have cable straps applied at intervals not greater than 10 feet for entire length of vertical and horizontal run.

4.2 PHASES OF IMPLEMENTATION

- A. Provide a consolidated and integrated schedule.

4.3 EXAMINATION

- A. The Contractor shall perform a detailed inspection of the site prior to submitting any technical data for approval.
- B. The Contractor shall verify that the proposed equipment and methods of installation are compatible with the existing conditions and prepare a corresponding written report of their findings.
- C. LAWA shall be notified in writing if modifications of the existing building are required in order to accommodate the new equipment. These modifications shall be made only upon receiving written approval from LAWA.
- D. Submit installation drawings for LAWA review and approval.

4.4 AP SITE SURVEY

- A. A full site survey of the Terminal(s) shall be conducted in order to determine and document the exact number, placement, and coverage of access point devices and the type of antenna required by each to provide full wireless network coverage. The contractor shall carry out and document the survey at its cost, working closely with Design Consultant and stakeholders.
- B. Upon concurrence and approval of AP design and layout, provide installation, programming and commissioning of all AP and wireless network components.

4.5 INSTALLATION

- A. APs shall be horizontally recess mounted with facing down toward the floor. The contractor shall pull two (2) Ethernet cables (CAT 6A or the latest) with RJ-45 terminations for each of



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- the AP installation. The Contractor shall notify LAWA prior to any AP installation where the AP faces a large metal object or the AP can only be mounted in vertical orientation.
- B. APs shall be mounted at temper-safe places and be at least eight feet above, but not higher than fifteen feet, above ground. APs in public areas shall have a security device installed to prevent removal of the AP by an unauthorized person. The Contractor shall confer with LAWA Office of IT Infrastructure Technology on acceptable security device.
 - C. The Ethernet network patch cable to the APs shall be yellow in color. This jumper cable shall be labeled with the AP's MAC address at each end.
 - D. APs must be installed with adequate clearance to allow a technician to perform periodical maintenance safely on a ladder.
 - E. APs shall be provisioned and tested before mounting. For example, the AP shall be physically connected to a switch port. Then the AP's working condition shall be verified by examining its LEDs according to the guidelines published in the AP's installation manual.
 - F. Each cable between the AP and the demarcation point must be tested end-to-end and certified with a cable tester. The report of the test results for each cable must be individually identified and submitted to LAWA Office of IT Infrastructure Technology.
 - G. At the end of the project, the Contractor shall configure the network switch port where the APs are connected to as part of the switch port requirement. Contractor shall contact LAWA IMTG – Office of Infrastructure Technology for the latest switch port configuration guidelines.

4.6 TESTING AND ACCEPTANCE

- A. LAWA contractor shall follow the standards and procedures set forth for the Wi-Fi system and/or equipment performance test and acceptance in this section.
- B. Test Plan
The Contractor shall submit a Test Plan for review and approval by LAWA IMTG Office of Infrastructure Technology forty-five (45) days prior to the scheduled start of the test. Test plans shall contain at a minimum of the following:
 - 1. Objectives of the test. Network connectivity and interconnect as well as equipment and/or network performance and coverage shall all be a part of the objectives.
 - 2. A single line diagram of the test showing the device under test, the network and the testing tool (hardware and/or software).
 - 3. Test procedures.
 - 4. The identification of the test equipment by manufacturer and model number.
 - 5. The expected test results and performance specifications wherever applicable.
 - 6. The attachment of the manufacturer documents wherever applicable.
- C. Connectivity and Coverage Test
 - 1. AP to Layer 2 Switch Connectivity Testing
 - a. Contractor to validate that there is a link light on the switch port where the AP is connected to.
 - b. LAWA IMTG to validate that there are no errors (Cyclic Redundancy Check, inputs) on the switch port.



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2. AP to Controller Connectivity Testing
 - a. LAWA IMTG to validate that the newly installed AP is successfully associated with the designated controller.
 3. User to WLAN (Wireless Local Area Network) Testing
 - a. LAWA IMTG to provide DHCP (Dynamic Host Configuration Protocol) service for the SSID (Service Set Identifier).
 - b. LAWA IMTG to validate that a wireless user can successfully connect to the SSID with an acquired IP address.
 4. Coverage Validation
 - a. Contractor shall provide a heat map for the installed AP's coverage area and record a minimum of four (4) readings in terms of the radius distance from the AP, with each of the reading corresponding with the four (4) quadrants where the RSSI (Received Signal Strength Indicator) at -65 dBm.
- D. Testing Procedures
1. Test of devices and system shall be witnessed by designated LAWA IMTG personnel.
 2. The contractor shall not proceed with the testing without receiving LAWA approval of the test plan.
 3. All testing procedures, expected results and tested results shall be recorded. If the tested results are outside the expected result range, the contractor shall conduct corrective tests until the expected results are achieved. All tests shall be recorded..
- E. Test Report
1. The Contractor shall submit the test report to LAWA IMTG in documenting the date and time of the tests, the name of the individual(s) who performed the tests, the test equipment used, the testing procedures, the expected test results, and the actual test results.
 2. If multiple tests were performed to achieve the expected results, description and/or analysis of the errors and corrective solutions shall accompany the test report.
 3. The test report shall be submitted within three (3) business days from the completion of the test.
- F. Final Inspection and Acceptance
1. LAWA reserves the right to physically inspect the entire contractor installation.
 2. After the inspection of the installations and the review of test report, LAWA shall provide the contractor with a punch list detailing the deficiencies to be corrected. The contractors shall work with LAWA to finalize the punch list with a target date for correcting all of the items on the list.
 3. Following the completion of the corrective steps for the punch list, LAWA shall conduct a final inspection.
 4. Steps 1-3 shall be repeated until LAWA accepts all punch list corrections.
 5. LAWA shall inform the contractor of the final acceptance of the system.



4.7 STARTUP

- A. The Contractor shall not apply power to the system until after:
 - 1. System and components have been installed and inspected in accordance with the manufacturer's installation instructions.
 - 2. A visual inspection of the system components has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
 - 3. System wiring has been tested and verified as correctly connected as indicated.
 - 4. All system grounding and transient protection systems have been verified as properly installed and connected, as indicated.
 - 5. Power supplies to be connected to the system and equipment have been verified as the correct voltage, phasing, and frequency as indicated.
- B. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment.

4.8 IDENTIFICATION AND LABELING

- A. See IT Infrastructure Standards of Practice Volume 3, Chapter 1.
- B. All Wi-Fi devices shall have a LAWA asset tag affixed. The Contractor shall obtain the asset tags from LAWA.

4.9 COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM (CMMS)

LAWA CMMS: Information regarding all equipment including model, nomenclature, serial number, function, LAWA Asset Tag number, AP location, AP MAC address, IP address, switch/port information, AP latitude and longitude coordinates, distance from AP to switch port, IT room, recommended preventative maintenance schedule, Quality Assurance Inspections and other pertinent data will be stored in the CMMS database. Contractor shall include in their Bid the cost for collecting and inputting this data for all systems and equipment provided by this Contract into this database.

4.10 CLOSEOUT ACTIVITIES – ACCEPTANCE & MAINTENANCE

Acceptance - Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation including data input of all installed cables in the LAWA management system and successful performance of the system for a 90-day period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, LAWA shall be provided with a numbered certificate from the Manufacturer registering the installation.

END OF SECTION 27 21 33