1.1 GOALS

A. The goal of this section is to provide standards for all art lighting at Los Angeles World Airports (LAWA). Additional discipline-specific guidance related to electrical work can be found throughout the Design & Construction Handbook (DCH) including, but not limited to electrical and sustainability guide specifications. These standards provide information for the art lighting component at LAX and provide the project design team the ability to have a unique lighting experience while keeping with LAWA guidelines. As LAX is a transitory space, the lighting requirements should be considered as a transition space where long-term viewing of art at close distances is not the predominate experience.

1.2 GENERAL

A. Art lighting fixtures and design shall provide the lighting levels, visual comfort, color rendering and aesthetics to complement the artwork and the area in which it is installed. Lighting of artwork is especially important to LAWA and all art lighting design, **including photometric calculations**, shall be approved by LAWA prior to submitting 90% construction documents for plan check. All lighting shall be installed in areas that are accessible by ladder or lift for ease of maintenance. Artwork types anticipated include wall-mounted, floor-mounted, suspended, free-standing cases and built-in casework.

1.3 STANDARDS

A. The art lighting design shall follow the following industry standard guideline:

1. IES Lighting Handbook, 10th Edition

B. The art lighting design shall reference the following industry standard guideline:

1. ANSI/IES RP-30-17 Recommended Practice for Museum Lighting

1.4 LUMINAIRE REQUIREMENTS

A. All lighting design shall be high efficacy, energy efficient and shall comply with the latest Title 24 requirements. Dimmable LED's shall be required utilizing 3000K - 3500K color temperature (LAWA requirement); provide consistent color temperature (tight binning), high CRI (85+), and rated life >50,000 hours.

1. General:

   a. Luminaire manufacturer shall have a minimum of five (5) years' experience in the manufacture and design of LED products and systems and no less than one hundred (100) North American installations.
   b. Unless otherwise specified, all LED luminaires and power/data supplies shall be provided by a single manufacturer to ensure compatibility and consistency.
   c. All LED sources used in the LED luminaire shall be of proven quality from established and reputable LED manufacturers and shall have been fabricated after 2007.

2. Replacement and Spares:

   a. Manufacturer shall provide written guarantee of the following:
      (1) Manufacturer will keep record of original bin for each LED module and have replacement modules from the same bin available for five (5) years after date of installation.

(2) Manufacturer will keep an inventory of replacement parts (source assembly, power and control components).
(3) Manufacturer's LED system will not become obsolete for ten (10) years: Manufacturer will provide exact replacement parts, or provide upgraded parts that are designed to fit into the original luminaire and provide equivalent distribution and lumen output to the original, without any negative consequences.

b. All parts of system shall replaceable in field. Manufacturer shall provide written guarantee of the following:
(1) Manufacturer has in place a written recycling and re-use program, and will accept returned product and/or components for recycling or re-use.
(2) Manufacturer will properly dispose of non-recyclable components that are deemed harmful to the environment.

c. System shall carry a full warranty for five (5) years. Additional warranty may be purchased by the project or Owner.

3. Products and Components – Performance

a. LED luminaires and components shall be UL listed or UL classified (or equivalent approved agency such as ETL).
b. LED luminaires and components shall be CE certified.
c. LEDs shall comply with ANSI/NEMA/ANSLG C78.377-2008 – Specifications for the Chromaticity of Solid State Lighting Products. Color shall remain stable throughout the life of the lamp. Color shall match approved sample.
d. LEDs shall comply with IESNA LM-80 – Standards for Lumen Maintenance of LED Lighting Products

4. LED sources shall have no measurable (UV) or infrared (IR) emission in the light beam.

5. Luminaire shall meet a minimum flicker threshold of 120Hz. (IES recommendation)

6. Luminaires shall have at least 50 lumens per Watt out of the aperture (efficiency).

7. Preferred manufacturers include:

a. Lighting Services Inc.
b. Edison Price Lighting
c. Erco Lighting
d. Intense Lighting
e. Philips Lightolier
f. Endo Lighting Corp
g. Solais Lighting
h. Luxam Lighting
i. Cree Lighting
j. Nordlux
k. Opto Light

8. All fixtures shall be approved by LAWA prior to specification, provide sample for review.

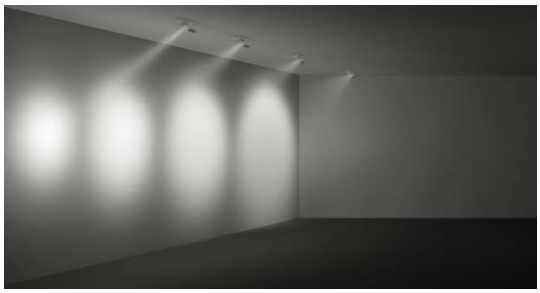
1.5 LUMINAIRE APPLICATION

A. Track-mounted lighting shall be utilized for most art lighting to allow for lighting of many different types of artwork and easy adjustment of lighting when artwork changes.

1. Track shall be continuous for the full length of the art locations, or contain breaks no larger than 12 inches. (LAWA requirement)

2. Luminaires shall allow for full adjustment of pan and tilt angles to allow aiming at artwork. Pan and tilt angle indicators are desired "for tilt and rotation precision. This is especially important where multiple accents are used in close proximity and where each is to produce an identical lighting effect. [Also desired is] locking capability to lock tilt and aim once set in the field. This minimizes, if not eliminates, misalignment that can occur during relamping or cleaning." (IES Lighting Handbook 10th Edition 15.1.2.1)

3. Luminaires shall allow for field changing of optics (reflectors) and integration of multiple field-changeable optical accessories (louvers, lenses etc.) and glare reduction accessories (snoots, visors). This is important to allow for shaping of the light on the wall from general wash to specific highlighting of various size artworks, as well as reducing luminaire brightness and glare.



Erco Lighting

B. Built-in and free-standing cases shall have integral casework lighting of artwork – external lighting may create veiling reflections in the glass. Coordinate with casework designer. Luminaire types may include linear, recessed or surface-mounted adjustable.

1. Luminaires shall be hidden from view wherever possible.

2. Linear luminaires shall be lensed to prevent view or reflection of individual LED diodes.

3. Remote power supplies and dimmer controls shall be located in a secure, concealed, accessible and well-ventilated location away from artwork.

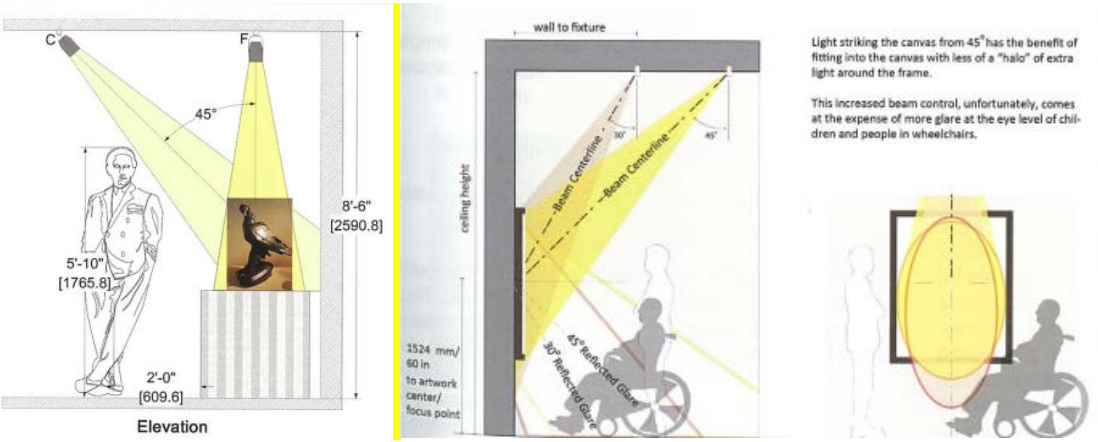
4. Casework glass shall be non-reflective glass to prevent veiling reflections over views of the artwork.

C. Motorized luminaires may be considered for special applications.

1.6 LOCATIONS AND ANGLES

A. Industry standard is a 30-35deg aiming angle to the artwork to prevent glare and veiling reflections on glass. The airport environment is largely transitional so there is less concern of glare and veiling reflection and more focus on uniform light levels created by higher aiming angles. Locate track to provide a nominal 45-degree angle to the artwork. Lower angles than 45deg (closer to the wall) will provide less uniform light levels, higher angles than 45deg

(further from the wall) create more risk for direct and reflected glare and shadowing of art by visitors.



ANSI/IES RP-30-17 Museum Lighting

B. Per existing LAWA standards, a 6' setback from the wall is standard for single-story walls to provide uniform light levels across the wall for any size artwork, and to allow for artwork of varying depth off the wall including free-standing artwork against the wall. Multiple track locations may be required to provide appropriate lighting angles and uniform light levels for taller walls.

C. Provide wide-optic "wallwash" or "flood" luminaires evenly spaced one to three feet on center to provide uniform light levels across the top of wall. Also allow for medium- or narrow- optic luminaires evenly interspersed to light the bottom of the wall to match light levels from the wallwash luminaires. These can also be used to spotlight/highlight the artwork against the rest of the wall/wallwash. These luminaires shall be equipped with accessory lenses such as linear spread lenses, softening lenses for more even illumination or to fine-tune the distribution.

1.7 CONTROLS

A. All art lighting shall be dimmable. Provide dual-circuit-dimmable track with separate control every 14-16 feet (LAWA requirement) to allow for separate dimming of wide- and narrow-optic luminaires, and/or lighting of different artwork to different light levels. Alternatively provide on-board or wireless (Bluetooth) dimming of individual luminaires. Art lighting shall be switched separately from the rest of the architectural lighting to allow for turning off late at night or if art is not being displayed at that location. All controls and dimmers shall be in a secure, concealed and accessible location.

1.8 LIGHT LEVEL CRITERIA

A. Provide light levels on artwork walls for five to ten times the average ambient light levels for "Feature" level emphasis on the artwork (IES Lighting Handbook 10th Edition Table 15.2). Provide light levels of 60-80 foot-candles average, 140 foot-candles maximum (LAWA requirement).

B. Light level uniformity across the individual artworks should be 2-to-1 average-to-minimum and 4-to-1 maximum-to-minimum. Uniformity across entire walls should be 10-to-1 maximum-to-minimum (IES Lighting Handbook 10th Edition 15.1.2.3).

C. Light levels should be provided with artwork light sensitivity taken into account to reduce risk of significant deterioration.

1.9 LIGHTING DESIGN SUBMITTALS

A. Provide photometric calculation, based on actual architectural conditions, including appropriate reflectance values and light loss factors. Submit to LAWA Art Program for review and compliance.

1. Calculations shall be done with software such as AGI 32 or Visual.

2. Calculations shall be done in point-by-point format with elevation views and shall include mounting height, on-center spacing, luminaire type, distance to wall, lumen information, light loss factor information and all appropriate industry standard levels. Elevation views shall show calculation points at 2’ on center spacing in both directions, from floor to ceiling of the art location wall.

B. Design shall indicate initial system luminaire quantities as well as system maximum capacity of luminaire quantity or power.

1.10 LIGHTING DESIGNER QUALIFICATIONS

A. The lighting designer shall be a member of International Association of Lighting Designers or a Certified Lighting Designer.

1.11 EXTRA STOCK

A. Furnish to the Owner and store at the site where directed, extra stock of each type of lighting fixture type and installed in the Project in quantities as required by Owner, packaged in manufacturer’s unopened cartons and identified as to contents by fixture type.

B. Furnish items above with appropriate quantity of each optical accessory, reflectors, glare shielding or other components available for the luminaire.

1.12 INSTALLATION

A. Provide labor and materials for final aiming of all adjustable fixtures under the Architect's supervision. Aiming shall take place immediately before building is turned over to Owner, after regular working hours where required.

B. Provide setting of dimming levels under the direction of the commissioning agent or Architect/Lighting Designer.

C. Provide training in system operation for Owner.

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