



## **1.1 GOALS**

LAWA controls three airports, with numerous structures built at different times to different structural standards. As airport facilities are replaced, added, or upgraded, LAWA intends to improve structural seismic safety and minimize the potential for interruption of airport operations that may be caused by a major regional earthquake. The goal of these standards is to establish a framework for implementing enhanced seismic design of airport facilities without unnecessary cost or schedule impacts, as well as to establish uniform design standards for new buildings.

## **1.2 BASIS OF STRUCTURAL / SEISMIC DESIGN**

- A. Major New Building Projects. New terminal buildings and other major projects will typically be required to meet enhanced seismic performance objectives. Certain facilities may be strategically designed for higher seismic performance objectives than others. The performance objectives will be established in the Project Definition Booklet (PDB) for CIP projects, and in the Concept phase for non-CIP projects. The method of design will be determined at the beginning of design by the Project Management Team (PMT) and clearly indicated in the contract documents. The PDB will determine whether and to what extent enhanced seismic performance is desired, taking into consideration the structure's function, life expectancy, interdependence on other existing structures, and other factors.

Where required in the PDB or Concept phase, enhanced seismic performance objectives may be achieved by one of two means:

1. Performance Based Engineering (PBE).
2. Code based prescriptive methodology, using an increased importance factor.

PBE methods are generally preferred from a cost/benefit standpoint. However, where PBE procedures are used, such procedures shall only be used to establish the *enhanced* performance objectives, and shall be completely separate from the Code-based review and approval process of the Governing Code Authority. Structural designs must also conform to current Code unless expressly agreed otherwise by the PMT. PBE designs shall be subjected to a Peer Review responsible to LAWA. PBE design for enhanced seismic performance should adhere to recognized national standards, and the performance objective shall be clearly indicated on the drawings.

Wherever possible, approval by the governing Code authority should not be contingent on acceptance of a Peer Reviewed PBE analysis and design. A parallel set of non-PBE calculations will typically be required to obtain building permits on the basis of the governing Code authority's minimum requirements.

- B. Minor New Building Projects. Enhanced seismic design may be required for minor new building projects, depending on the use of the facility. New ancillary structures (comprising an expansion of an existing facility) should be designed to meet current Code and provide a level of seismic performance not less than that of the primary facility.
- C. Major Renovation Projects. Major renovations of existing buildings will require an initial structural review and assessment of the building's seismic force resisting systems. The seismic review shall establish the existing structure's seismic performance characteristics and feasibility for seismic upgrade. Seismic retrofit of existing buildings will typically require PBE. Feasibility for upgrade to both Life Safety and Immediate Occupancy standards should be established. Based on the results of the structural seismic assessment / feasibility study and the life expectancy of the structure, seismic performance objectives shall be established in the PDB or during the Concept phase with input from the stakeholders. Life Safety upgrades will be required as a minimum where required by Code.



Wherever possible, seismic strengthening should be undertaken on a voluntary basis, such that approval by the Governing Code Authority is not contingent on acceptance of a Peer Reviewed PBE analysis and design. A parallel set of non-PBE calculations will typically be required to obtain building permits on the basis of the Governing Code Authority's minimum requirements for voluntary seismic strengthening.

- D. Parking Structures at LAX. Due to the corrosive marine environment at LAX, parking structures shall conform to Code and the latest edition of ACI 362, "Guide for the Design and Construction of Durable Concrete Parking Structures." The Durability Exposure Zone shall be considered to be "Coastal Chloride Zone I", unless a more stringent zone is appropriate.
- E. Non-Structural Systems. In order to minimize the potential for interruption of airport operations, non-structural systems shall be designed for enhanced seismic performance wherever practical. Systems with pre-existing seismic certification shall be used when available. Distribution systems shall be designed per Code requirements for the applicable seismic performance objective. Where practical, composite utility drawings shall be required. The seismic design shall be submitted as a deferred submittal to the Governing Code Authority, LAWA and the Structural Engineer of Record (SEOR) for review.

Non-structural components shall include, but not be limited to, architectural components, BHS systems, MEP equipment, mechanical ducts, VAV boxes, piping, conduits, cables, ceilings, shelving, cabinets, access floor systems, partitions, glazing, signs, antennas, plumbing and fire protection pipes, electrical lighting, IT server racks, vending machines in public spaces, billboards, FIDs, BIDs, bookshelves, artwork, casework, etc., and similar furniture/equipment taller than 6'-0" or weighing more than 200 pounds with a height to width ratio  $\geq 3:1$ .

### **1.3 AIRPORT-SPECIFIC STRUCTURAL ELEMENTS AND STANDARDS**

- A. Apron Slabs and Structures Surcharged by Aircraft Loading: Apron slabs, tunnels below runways/taxiways, and adjacent retaining walls shall be designed to support loads generated by the largest aircraft and ground service equipment (GSE) (See Section 1.4).
- B. Vehicle Impact Barriers: Airside structures and pad-mounted equipment exposed to GSE or other vehicle traffic shall be protected by yellow painted bollards and k-rails designed for vehicle impact as outlined below. Structural steel columns shall be encased in reinforced concrete a minimum of 6' above the apron.
- C. Light Poles: Light pole design adjacent to the Air Operations Area (AOA) may be affected by jet blast loading (See Section 1.4).
- D. Passenger Boarding Bridges (PBB): PBBs adjacent to the AOA may be affected by jet blast loading (see below). Seismic performance of PBB supports and foundations shall match the performance objective of the associated building.
- E. Baggage Handling Systems (BHS): Structures shall be designed to support localized reactions from baggage handling systems without requiring strengthening (See Section 1.4).

### **1.4 AIRPORT-SPECIFIC STRUCTURAL LOAD CRITERIA**

- A. Gravity Loads.
  - 1. In addition to all Code specified loads, public areas of Terminal Buildings shall be designed to support a 10,000lb maintenance lift (Falcon Reachmaster FS-105 or similar). Such loading may be considered non-concurrent with full Code specified live



loads. Additionally, a path of travel shall be identified on the drawings to get the lift from the exterior to each level of the Terminal.

2. To allow flexibility for reconfiguration of Terminal Building public areas, all floor areas on levels accessible to the public shall be designed for a minimum 100psf live load. All mechanical rooms shall be designed for a minimum of 150psf live load.
  3. Baggage Handling Systems (BHS). To allow for future reconfigurations of the BHS, a distributed superimposed dead load of 30psf may be used to account for reactions from BHS. Note this should apply to the levels above and below the BHS area. Specific reactions to structure must be checked by the SEOR prior to installation.
  4. Apron slabs on grade and structural slabs supporting aircraft or GSE shall be designed for the heaviest aircraft and associated GSE. GSE may be considered as 140,000lb. Apron slabs shall be unreinforced unless approved by LAWA, or as noted below.
  5. Tunnels and retaining walls under / adjacent to roadways or apron slabs shall be designed for traffic surcharge from vehicular traffic based on geotechnical engineer's recommendations, which shall consider the above aircraft and GSE loading at airside.
  6. Grease Interceptors, or other buried tanks (GI), located within 20' of the exterior face of the buildings shall comply with the following:
    - a. GI may be constructed of precast concrete, fiberglass, or other material approved by LAWA.
    - b. Apron slab and GI shall be designed to support the GSE noted above and the maximum loading from the nose wheels of the largest aircraft anticipated for the area. Design shall include all vertical and horizontal earth pressures from GSE, nose wheels, pavement, overburden, etc.
    - c. GI shall be oriented parallel with the building, based on the longest dimension of the GI, where possible.
    - d. GI installation shall disturb as few of the apron slabs as possible. Drawings shall reflect the actual layout of existing and panel revisions.
    - e. Apron slabs may be reinforced within 20' of the exterior face of the building. All reinforced slabs shall have metallic embeds cast into the four corners of the panel indicating that the panel is reinforced. Rebar shall be galvanized or epoxy coated.
  7. Grease Interceptors, or other buried tanks, located more than 20' from the exterior face of the buildings shall comply with the following:
    - a. GI shall be constructed of precast concrete.
    - b. Apron slab and GI shall be designed to support the GSE noted above and the maximum loading from the nose wheels, or the main wheels of the largest aircraft anticipated for the area. Design shall include all vertical and horizontal earth pressures from GSE, nose or main wheels, pavement, overburden, etc.
    - c. GI installation shall disturb as few of the apron slabs as possible. Drawings shall reflect the actual layout of existing and panel revisions.
    - d. Apron slabs shall not be reinforced, except for dowels across the construction joints.
- B. Wind Loads.
1. Due to the presence of the airfield, wind Exposure Category C is required at a minimum. Basic Wind Speed shall be per current Code.



2. Airside cladding elements exposed to jet blast shall be designed for 50psf applied to any 15sf area per FAA AC 150/5300-13A, Appendix 3, "The Effects and Treatment of Jet Blast."

*Exception: inset penthouse structures 40' or more above the apron level.*

C. Seismic Loads.

1. Airport site-specific response spectrums may be available electronically for digital download, depending on the dates and criteria noted. It is the designer's responsibility to verify the adequacy of any data provided by LAWA for project-specific requirements.
2. Refer to Section 1.2 for development of Basis of Seismic Design.
3. Due to local soil conditions, the deep basin effects on geotechnical parameters shall be considered for structures with periods greater than  $T_s$ .

D. Impact/ Other Loads.

1. GSE impact at bollards / K rails shall be based on a 140,000# vehicle decelerated from 25mph to 0mph in 1 second. It is permissible to allow failure of bollard or K rail under impact loads.
2. Partial height walls at Security Screening Check Point (SSCP) and any walls enclosing sterile areas shall be designed to resist Code applied loads as well as a 200# horizontal force at any location. Wall stiffeners shall be provided for partial height walls and shall be designed to resist a 5psf force with a deflection of  $L_{eff}/720$ . Such walls shall be designed with special emphasis on durability and ease of maintenance.
3. Maximum allowable horizontal handrail deflection is  $1/2"$ .

E. Blast Loads.

1. Blast load criteria, if required, shall be established by the SEOR in consultation with the PMT and applicable authorities.

## 1.5 **DRAWING REQUIREMENTS**

A. Structural contract documents shall clearly and concisely show the following items:

1. Design live loads and superimposed dead load maps.
2. Code-based lateral loading criteria.
3. Basis of Seismic Design, including any enhanced performance objectives in excess or in addition to stated Code requirements.
4. Foundation design parameters.
5. Strength and grade of all structural materials.
6. ICC #, and LARR (for LAX), for ALL proprietary products.
7. Assumed operating weights of all MEP equipment.