

# **Hartsfield-Jackson Atlanta International Airport**

**City of Atlanta**

**Department of Aviation**

**Office of Infrastructure Planning & Development**

# **Airport Facilities Landside/ Airside New Construction and Modifications**

*Design Standards*

# **Structural Engineering**

**Design Standards  
Structural**

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## Design Standards

### Structural

#### 1.0 Purpose

- A. The purpose of this document is to outline the basic design intent for structural engineering work performed by, or on behalf of the Hartsfield-Jackson Atlanta International Airport (ATL), Department of Aviation (DOA).
- B. All design work shall be performed in accordance with generally accepted professional principles and practices for structural engineering and in compliance with all applicable DOA Design Standards, Federal, State and City of Atlanta Design Codes, Standards and Regulations.
- C. In some cases, certain generally acceptable design alternatives are restricted or excluded because of the special needs of the airport environment. Every attempt will be made to identify these situations in this document.

#### 2.0 General

- A. Applicable Codes
  1. All design work shall be performed in accordance with generally accepted professional principles and practices for civil engineering and in compliance with all applicable Federal, State, and City of Atlanta Codes, Guidelines, Standards, and Regulations.
- B. Design Narrative
  1. All but the most minor structural engineering projects shall be summarized in a design narrative developed by the Structural Engineer of Record (SER). The design narrative shall describe the vertical and lateral load support strategies proposed for supporting anticipated loads.
- C. Design Calculations
  1. Basis-of-design calculations shall be prepared for all projects. The format and content of the calculations shall be as follows:
    - a. Cover Sheet
    - b. Table of Contents
    - c. Design Narrative – Overview of the design approach including the vertical and lateral load resistance strategies and load paths as well as the

- resolution of any unusual or atypical aspects of the design.
- d. Design Information – Provide a summary of design criteria, applicable codes applied loads and any design assumptions.
  - e. Major Element Design – Actual design calculations or the preliminary design activities leading to the development of input data for structural analysis/design computer programs.
  - f. Foundation Designs – Actual design calculations or the preliminary design activities leading to the development of input data for structural analysis/design computer program(s).
  - g. Miscellaneous structural detail design calculations – Actual design calculations or the preliminary design activities leading to the development of input data for structural analysis/design computer programs
  - h. References
  - i. Appendix – the appendix (or appendices) shall include all pertinent design materials that cannot be incorporated into the categories identified above.
2. Calculations shall be neatly presented and include sketches proportioned to reflect relative scale, illustrating design intent. Provide linkage in the calculations for all primary structural members. All commercial computer software utilized in the production of the design shall be identified by name and version. All input files and corresponding output files (in native format), shall be recorded to DVD/CD optical media, suitably labeled and included with the submittal.
  3. Any in-house proprietary computer software utilized in the design shall have the solution of verification problems documented in the appendix.
  4. Calculations shall be coordinated with the current design phase and shall be purged of any superseded material.
  5. All final calculations shall be sealed, signed and dated by the Structural Engineer of Record.
- D. Loads and Loading Combinations
1. Load combinations used for the design of airport structures shall be in strict compliance with the requirements of the applicable provisions of ASCE/SEI 7-16, Minimum Design Loads for Buildings and Other Structures (current printing) and the structural codes identified in the general requirement section above.11

E. New Construction

1. The structural framing system for new construction shall be the most cost-effective based on a life-cycle cost analysis based on the required design life of the structure as agreed by the Department of Aviation.

F. Modifying Existing Structures

1. As-built and design data sources utilized in the design shall be identified. Where this data has been supplemented by field acquired data or where all data has been field acquired, the raw and reduced data shall be submitted in electronic format to the Department of Aviation in an approved format without limitation on future re-use.

G. Framing System Economics

1. Prepare a summary of the pre-analysis performed to justify the structural framing system proposed.

H. Foundation Systems

1. Foundation designs shall be based on the recommendations of an experienced geotechnical engineer, licensed to practice engineering in Georgia, unless the structure is deemed to be of minor significance with the concurrence of the Department of Aviation.
2. Where soldier pile or other types of lagged wall systems are approved for temporary excavation support, the plans shall require removal of the upper five feet of such systems where they occur within the building footprint and ten feet at exterior locations after permanent construction is put in place.
3. Where micro-piled or similar specialty contractor foundation system is proposed and accepted by the Department, the SER shall provide on the drawings, details such as pile caps etc., necessary for successful incorporation into the work.

I. Delegated Design

1. Where portions of the design are delegated to specialty engineers, the Structural Engineer of Record shall provide written design requirements detailing the requirements to be met by the delegated design.
2. The Structural Engineer of Record shall review the design documents prepared by the Specialty Design Engineer for conformance to the intent of the engineer of record, meets the written requirement and has been prepared by a licensed Georgia professional engineer.

3. The Structural Engineer of Record shall confirm in writing that the specialty engineer's work on the project conforms to the Structural Engineer of Record's intent.

J. Drawings

1. All structural drawing plan packages shall include at a minimum, the following sheets in addition to others that are necessary to clearly define the scope of work for the project.
  - a. General Notes – General notes applicable to the overall design and structural materials proposed, abbreviations used within the structural drawings, symbol legend(s) as appropriate. The general notes shall include all the information required by section 1603 of IBC 2018
  - b. Columns, foundation elements, concrete beams and concrete joists (conventional or prestressed) shall be summarized in schedules and presented within the project plans.
  - c. Post-tensioning schedules shall indicate the required post-tensioning force and indicate the tendon drupe variation in each span as well as the location of points of inflection.
  - d. All prestressed concrete girder and major beam construction shall be bonded.
  - e. Where deep foundations are proposed, estimated pile/drilled pier tip and bearing elevations shall be shown on appropriate schedules.
  - f. Floor or bridge deck framing plans as appropriate as well as elevations, sections and details in sufficient number to adequately define the requirements of the work.
2. Final plans shall include one (1) plan set with manually affixed signature and date over the seal of the Engineer of Record.

K. Specifications

1. Specifications shall be prepared to define the quality of workmanship and materials that shall be incorporated into the work. They shall complement the structural design drawings.
2. The use of 'Sole source', 'Name brand' and/or 'Name brand or Equal' type references in the plans and specifications is not permitted without submitting a justification and receiving written approval from the City's Chief Procurement

Officer.

L. Design Milestones

1. Drawings and specifications for structural design items shall be submitted at all milestone delivery dates as required by contract. The level of completion shall reflect the percentage of completion represented by the milestone.

M. Quality Control Plan

1. All structural engineering document packages shall be vetted utilizing an approved Q/C plan submitted prior to commencing design activities. The plan will outline the effort and deliverables at each project review milestone for projects where such milestone reviews are required by contract. The Q/C deliverables plan shall be submitted and approved prior to submittal of the actual milestone design deliverables.

N. Miscellaneous

1. During the construction phase of projects, any changed condition, drawing deficiency or other circumstance that results in the issuance of an addendum, change order or bulletin that includes drawing modifications, supplemental sketches or deletions from the drawings shall be concurrently incorporated into the existing structural plans re-issued. The cost to make and to issue the updated drawing(s) shall be included in the base contract amount or any negotiated supplementary agreement.

### 3.0 Buildings

A. General

1. Building plans shall include sheet(s) indicating the various design loads (Live and Superimposed Dead) that have been used to develop the building structural system presented.
2. All reinforced concrete slabs within building footprints shall be detailed with bar steel reinforcement. Welded wire fabric shall not be permitted.
3. All building designs shall include summary reinforcement schedules for beam, column and foundation elements.
4. Design for temperature change shall be based on a mean temperature at construction of 62°F with a variation of  $\pm 50^\circ\text{F}$ .

B. Steel Framed Structures

1. Provide criteria for vibration design. At a minimum, conform to the recommended criteria of AISC Design Guide 11, "Floor Vibrations Due to Human Activity."
2. Where the slab overhang is 9 inches or less, SDI pour stop shall be specified to form the edge-of-slab unless this has been determined to be inadequate by the EOR.

C. Connections shall be designed by the SER or the Fabricator for actual end-actions determined by the EOR and not generically, based on member capacity. Concrete-Framed Structures

1. Cast-in-place conventional

- a. Lap splices between upper and lower columns shall be detailed as Class B splices under ACI 318, unless specifically agreed otherwise.
- b. Tolerances for concrete construction shall be in accord with the current edition of ACI 117, "Specifications for Tolerances for Concrete Construction and Materials and Commentary."
- c. The potential incompatibility between different construction materials shall be anticipated and appropriate guidance provided on the contract drawings or in the specifications.
- d. Formed surface Class shall be indicated on the contract drawings or in the specifications but shall not be less than Class C as defined in ACI 347 – Guide to Formwork for Concrete.
- e. Provide specific guidance regarding the allowable placement of conduits and pipes within concrete slabs and other concrete members. Address maximum size, spacing and other structural requirements.

2. Cast-in-place post-tensioned

- a. Observe applicable provisions for cast-in-place conventional concrete construction presented above.
- b. Post-tensioned construction shall be detailed with appropriate slip connections to prevent restraint cracking when members shorten due to the applied prestressing force or concrete volume changes.
- c. Prestressing tendons shall be detailed with adequate cover to meet the required fire rating for the structure being designed.

3. Precast

- a. The plans shall explicitly prohibit hard contact between adjacent precast concrete elements and include an absolute minimum separation inclusive of all tolerances.
- b. Unless explicitly agreed otherwise, precast concrete structures shall be designed and specified as Class U.
- c. Cracks in precast elements that are deemed to be structurally sound by the design professional of record, shall be sealed with a low-modulus epoxy repair material.

#### 4.0 Bridges

A. Roadway

1. Georgia DOT standards, details and specifications may be used where they do not conflict with airport standards, details and requirements.
2. All bridge widening shall be accomplished through the use of a pour strip. Pour strip components shall be constructed of accelerated strength concrete.
3. All bridge decks shall have epoxy-coated reinforcing steel top mats.
4. Design for temperature change shall be based on a mean temperature at construction of 62°F with a variation of  $\pm 50^\circ\text{F}$ .

B. Aircraft

1. All bridges, culverts and airfield structures shall be designed to support, at a minimum, FAA Group VI aircraft, current/anticipated airfield rescue and fire fighting vehicles and current/anticipated aircraft push-back tractors .

C. Pedestrian

1. Pedestrian bridges shall be designed for a live load of 100 psf.

D. Sign Bridges

1. Sign bridges and related structures shall be designed in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6<sup>th</sup> Edition.
2. Allowance shall be made in the design of sign bridges for a 10% increase in signage area over the life of the structure. The increased signage area shall configure so as to provide the maximum impact on the structure and foundations using multiple load

cases as necessary, to establish required structure and foundation design requirements.

## 5.0 Other Structures

### A. Parking Garages

1. All airport parking structures shall be designed for an unreduced live load of 50 psf or the effects of a 3 kip concentrated load acting on an area of 4.5" x 4.5", whichever is the more severe loading.
2. Parking structures shall also be designed to support a "mini-pumper" fire fighting vehicle with a 9000 lb axle and GVWR of 14,600 lbs. Minimum vehicle track considered in the design shall be 65 inches unless actual AFD equipment dimensions permit use of a greater value.
3. Cast-in-place, Post-tensioned Concrete
  - a. Cast-in-place post-tensioned concrete construction is the preferred form for parking garage structures. A Class B form finish shall be specified unless otherwise instructed by the Department in writing.
4. Precast Concrete
  - b. Precast prestressed concrete parking structures are permitted for airport construction where authorized by the Department in writing.
    - i. Where precast prestressed construction is approved for a parking garage structure, a cast-in-place, reinforced  
[1.] concrete topping slab shall be required to provide proper surface drainage.
    - ii. Precast concrete structures shall be designed and detailed such that deflecting members such as joists are not rigidly connected to stiff elements such as walls in a manner that restrains deflection of the joist.
    - iii. All precast, prestressed concrete flexural members shall be designed as Class U per ACI 318.

### B. Retaining Walls

1. In general, earth retaining structures shall be designed for lateral force parameters determined by a geotechnical investigation. The minimum factor of safety against overturning, sliding and global stability shall be 1.5. Additionally, for soil-reinforced

segmental retaining walls, internal component stability of 2.0 shall be provided.

2. Temporary earth retaining systems may be designed for such reduced factors of safety as the consultant typically employs in its practice, but in no event shall any factor of safety be less than 1.25.
3. Wall elevations shall feature, at a minimum, lines depicting the proposed top of wall, proposed grade in front of and behind the wall as well as the existing grade at the front of the wall.

C. Tunnels

2. Tunnel design and construction shall give due consideration, where appropriate, to potential soil heave at the bore and concrete shrinkage effects.

## 6.0 Construction Phase

A. Drawing Revisions

1. All bulletins, sketches and directives related to the structural drawings, issued during construction, shall be posted to the original electronic documents and provided to the Department of Aviation monthly.