



walter  
p moore

# Air Traffic Control Tower Expertise



# Firm Profile

Walter P Moore is driven to solve the world's most complex engineering challenges, and has a reputation for delivering unparalleled solutions since the firm's origins in 1931. We hold in high regard what clients do, the responsibilities they shoulder and the risks they assume, and we take on our clients' challenges as our own.

Our ambitions are fueled by our diverse teams of highly-skilled engineers, managers and technical specialists who collaborate within an inclusive environment and contribute a wide range of industry-leading expertise to design innovative, thorough and economically-sound solutions. We work together globally, operating as a single firm-wide profit center motivated to collaborate rather than compete across offices or practices. We structure our teams to meet project and partner needs by bringing together the most relevant and experienced subject matter experts—regardless of location—with local staff who have strong relationships and a deep understanding of regional conditions. And we support them with a firm-wide platform of shared knowledge, systems and processes that empower our teams to deliver meaningful, valuable and sustainable results for our clients and communities.

**In all of our work, every day, we have a firmwide commitment to our clients, our projects and to ourselves to cultivate:**

- › **Design excellence;**
- › **Efficient delivery;**
- › **Diversity, equity, and inclusion;**
- › **Environmental sustainability; and**
- › **Continuous research and innovation.**

## SERVICES:

- › Structural Engineering
- › Parking
- › Construction Engineering
- › Secure Design
- › Enclosure Engineering
- › Restoration & Renovation

As industry-leading engineers, Walter P Moore recognizes the importance of our work and the impact we can have when we make these commitments, ultimately transforming the experience of our team members and the outcomes of our clients. We not only prioritize reliability, ensuring that projects are executed with precision, on time and on budget. We also emphasize design, crafting innovative solutions that merge lasting beauty with long-term performance. We do all of this within an inclusive and collaborative workplace where team members feel empowered to contribute their own unique knowledge and experience, as each gains from the firm's ongoing research and investigation, collectively advancing the engineering practice.

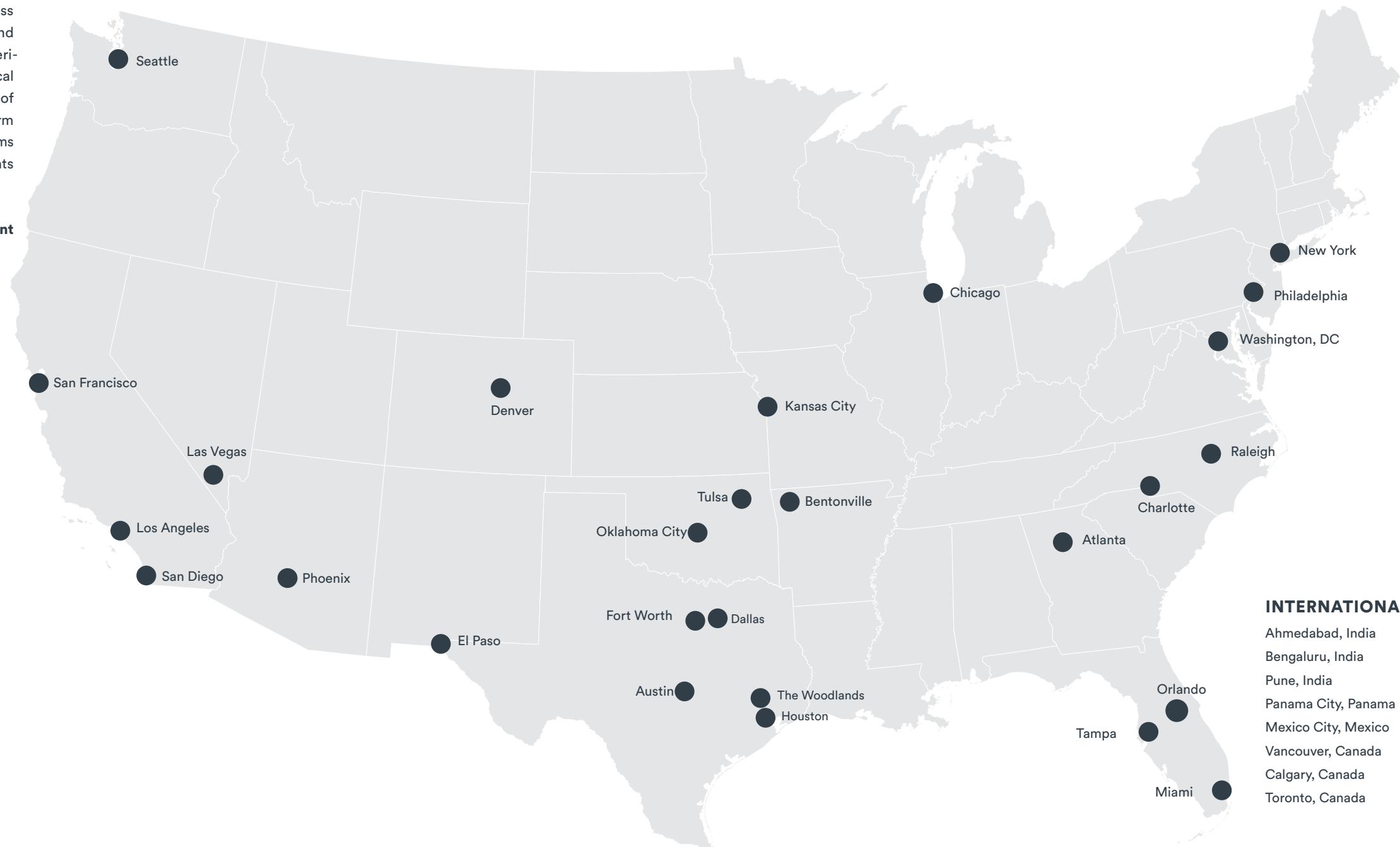
## TOTAL STAFF COUNT

**1,000+ 373**

## LICENSED PROFESSIONALS

## FOUNDED IN

**1931**



# Multidisciplinary Integrated Platform

## STRUCTURAL DESIGN

### STRUCTURAL ENGINEERING

- › High strength and stiffness requirements
- › Accommodation of high-rise exiting and elevators
- › Coordination with FAA infrastructure for current and future communication, electrical, and data lines
- › Detailing for fast erection
- › Shaft access systems for maintenance

### CAB DESIGN

- › 360-degree view
- › Multi-purpose column-mullion assemblies serve structural, enclosure, electrical, and plumbing functions
- › Coordination with FAA infrastructure for current and future communication, electrical, and data lines
- › Collaboration with enclosure engineering

### WIND ENGINEERING

- › High wind exposure
- › Motion-sensitive operations
- › Coordination with wind-tunnel testing
- › Design of tuned-mass damping system (for taller towers)
- › Coordination with enclosure engineering
- › Performance-based wind engineering to validate design in high-wind regions

### SEISMIC ENGINEERING

- › Critical post-earthquake function
- › Exacting earthquake-performance goals
- › Coordination with wind-tunnel testing
- › Innovative system design
- › Performance-based seismic engineering to validate design in high-seismic regions

## ENCLOSURE ENGINEERING

- › 360-degree view from cab
- › Specialty glazing for optimal view
- › Unique glazing geometries
- › Limited-access facade systems
- › Multi-purpose column-mullion assemblies serve structural, enclosure, electrical, and plumbing functions
- › Coordination with electrical design
- › Collaboration with structural engineering



## SECURE DESIGN

- › Expertise in completing the Facility Security Level (FSL) determination in accordance with the Interagency Security Committee (ISC) Risk
- › Experience in supporting the FAA and the local aviation stakeholders on FSL process
- › Coordination with design team to ensure project physical security measure are incorporated into the ATCT project's design
- › Physical security measures may include operational security measures, site security, security technology, and physical hardening of the ATCT and any associated building components



# Structural Engineering

Through the decades, Walter P Moore has systematically built an industry-leading structural engineering practice around creativity, reliability and teamwork. Our success is attributed to our dedication to our craft, to our commitment to research and innovation, to our shared passion for positive impact, and most importantly, to our reputation for being collaborative and trusted team players. We provide a comprehensive set of structural engineering services to support the design, construction and improvement of building structures. We work with the world's leading architects, developers, owners, and builders to deliver structures that are recognized among the world's best. Our robust platform of resources and deep bench of experience not only give us the ability to design any building with structural and environmental conditions ranging from normal to extreme, but also give our clients and collaborators the confidence that they are gaining the most effective, efficient and valuable solutions.

## SEISMIC ENGINEERING

In seismic zones, the criticality of the ATCT function—allowing post-earthquake air traffic for relief—adds another level of requirements. The FAA has refined its performance expectations to ensure continued operation under all but the rarest earthquakes, requiring innovative approaches to strength design for both the tower shaft and the cab. Ground motions in excess of 1g and magnitudes approaching 8.0 are considered in some locations. Performance-based design and nonlinear response-history analysis are effective means of meeting these requirements. Walter P Moore has used these methods on multiple west-coast ATCTs.

## CAB DESIGN

The cab itself presents a particular challenge: the cab roof must be supported and braced for lateral loads, but the structure must be minimized and positioned to preserve 360-degree view lines for controller operations. Additionally, cables form roof-top antennae, and data systems (as well as rainwater pipes) must be accommodated in the structure to avoid any unnecessary obstruction of sight lines. Often, hollow, thick-walled perimeter structural columns are used; these double as cab-glass mullions. Coordination with electrical and collaboration with enclosure engineers provides for minimal obstruction of the controller's view.

## STRUCTURAL ENGINEERING OF A DATA-INTENSIVE HIGH-RISE TOWER

Structural design of ATCTs presents several challenges and requires balancing multiple criteria. ATCTs require a strong, stiff shaft to elevate the controllers to the optimal position and provide a stable, comfortable operating environment. The shaft design must accommodate multiple base openings for both personnel and for data and electrical lines, and must be detailed for fast erection. Additionally, exterior maintenance requires high-rise style access, but with minimal roof areas for gondolas, davits, etc.

Modern ATCTs require significant equipment and support space such that they are designed as high-rise buildings and require two exit paths, as well as significant vertical data and electrical lines. Intense coordination between architectural, structural, and electrical disciplines is required to minimize the shaft dimensions.

## WIND ENGINEERING

Because of the high wind exposure, tower sway can lead to operator discomfort. For taller towers, this is often best addressed by the addition of tuned mass dampers. Wind-tunnel testing is required to determine the level of wind-induced vibration and thereby determine whether supplemental damping is needed. The wind-tunnel results are used to refine the design, establish design pressures for cladding, and inform the design of a tuned-mass damper (if required). Walter P Moore's capabilities for performance-based wind engineering can be applied to ATCT design in hurricane and other high-wind regions.

“ Thank you for the work Walter P Moore has done to help move the JFK New Terminal One project forward. And thank you for the commitment made to excellence and strong engagement to local and MWBE. It's been a long road and Walter P Moore played a big role.

— Gerrard Bushell, PhD, Chair, The Carlyle Airport Group  
President and CEO, JFK New Terminal One



# Enclosure Engineering

More than any other component, the enclosure of a building – including its facades, roofing and subsystems – influences its aesthetics and operational performance. A precise balance of design, system performance and cost are critical to project success. Walter P Moore's highly specialized building enclosure practice leads the industry in addressing these concerns, while simultaneously navigating the increasing complexities of rising costs and compressed schedules.

Our multidisciplinary team, consisting of designers, engineers, and computational specialists, collaborates across the entire project team and through each project phase – touching nearly every discipline at some point to address the 'gap' between design and construction – to supply timely and objective input regarding material and system selection; system interface definition; performance objectives and coordination; holistic weather tightness strategies; and design detailing and coordination. By employing seasoned engineers as part of the team, and being positioned within a larger engineering practice, our team not only validates proposed concepts, but also develops fully engineered solutions to complex enclosures, avoiding surprises down the road. Leveraging both our inherent

knowledge and gathered data, our specialists develop custom-tailored systems and strategies to address local climate conditions, sustainability performance targets, and occupant comfort, that not only minimize building energy and carbon usage, but also meet the project's design vision. We advise on procurement strategies and can guide the design process through performance based design, ultimately offering holistic stewardship of the building envelope throughout its life cycle and ensuring that it honors the original design vision, meets long-term performance goals, is highly sustainable, and is cost effective to build and maintain.

## ATCT CONTROL CAB DESIGN

ATCT control cab design requires 360-degree views for controller operations. Control cab views for controller operations. Control cab glazing systems present unique design considerations related to geometry, glass clarity, visual distortion, acoustics, thermal performance, and condensation risk. In addition, perimeter structural columns often double as mullions for the cab-glazing system to minimize visual obstructions, so close coordination is needed between cab glazing design and structural design.

“Walter P Moore re-defined industry standard practices in order to solve our unique design constraints and their team integrated so seamlessly into our process that their expertise felt like a direct extension of our internal design team. These are exactly the things you want when working with a consultant.

— Phil Kolbo, Populous



# Secure Design

Walter P Moore provides a full range of secure design services that create practical, technologically-advanced solutions for physical security and structural protection against threats from natural disasters and terrorism.

Fully integrated with our structural design capabilities, our secure design services include preliminary security planning and site layout, threat and risk assessment and mitigation, designs to resist extreme loadings, protection from blast, progressive collapse, forced entry, ballistics, and vehicle ramming.

Our specialty team of secure design engineers also provides blast load prediction, vehicle ramming threat analysis, secure design of glazing and framing, and structural component response prediction for elements subjected to blast loading. Single and multiple degree-of-freedom tools and finite element analysis help us determine structural response to complex dynamic loadings.

Walter P Moore's designs fully incorporate various General Services Administration (GSA), Department of Defense (DOD), Interagency Security Committee (ISC), and Department of Veterans Affairs design criteria documents. Our team is active in the physical security community, including participation in further development of these documents and design methods for use throughout the industry.



“

We were very pleased with the skill and ingenuity that Walter P Moore brought to the task of creating this amazing structure. They were able to convince the FAA to deviate from their traditional prescriptive structural design to a performance based structural design which allowed for the post tensioning building. They showed a strong personal commitment to the success of our project. Their responsiveness during construction — especially in the face of some initial concrete core construction surprises — and their overall focus on constructability and cost was a major factor in our ability to complete our project within budget. The SFO ATCT is truly a work of structural engineering excellence.

— Geoffrey Neumayr, SE, Deputy Director, SFO International Airport

# Aviation Experience

Walter P Moore is one of the leading structural engineering firms for airport design. We specialize in complex, long span, challenging projects, and have worked on multiple large capital expansion programs over the last 30 years.

The expectations of the modern traveler demand that today's aviation facilities be secure, attractive, easy-to-use, and loaded with amenities. As airports are expanded and improved, a variety of new facilities are being constructed, including landside and airside terminals, hangars, and parking facilities. Operational requirements and capacity upgrades have spawned extensive renovations and modifications to existing terminals.

We combine a deep knowledge and understanding of the aviation industry with creative engineering solutions to successfully deliver diverse projects in the airport environment. Walter P Moore has supported numerous of airports, including 5 of the world's busiest. **We have designed over 25 million square feet of new and renovated airport facilities.** In addition, the firm has contributed to various aviation facility improvements, including ticketing, baggage claim, and FIS renovations, pedestrian and vehicular bridge additions, and vertical and horizontal transportation additions.



**300+** **25** **\$25b+**  
INTERNATIONAL AIRPORTS AVIATION PROJECTS DELIVERED



## AIR TRAFFIC CONTROL TOWERS

ANC - Ted Stevens Anchorage Int'l Airport  
DYS - Dyess Air Force Base  
JPN - Pentagon Army Heliport  
MEM - Memphis International Airport  
SFO - San Francisco International Airport  
SJC - San Jose Mineta Int'l Airport

## TERMINALS/CONCOURSES

ATL - Hartsfield-Jackson Atlanta Int'l Airport  
AUS - Austin-Bergstrom Int'l Airport  
BNA - Nashville International Airport  
CRP - Corpus Christi Int'l Airport  
DCA - Ronald Reagan Washington Nt'l Airport  
DFW - Dallas/Fort Worth Int'l Airport  
EWR - Newark Liberty Int'l Airport (SD Only)  
IAD - Washington Dulles Int'l Airport  
IAH - George Bush Intercontinental Airport  
JFK - John F. Kennedy Int'l (Concept Design)  
LAS - Harry Reid International Airport  
LAX - Los Angeles International Airport  
MCO - Orlando International Airport  
MSY - Louis Armstrong New Orleans Int'l  
OMA - Eppley Airfield  
PDX - Portland International Airport  
PIE - St. Petersburg-Clearwater Int'l Airport  
RSW - Southwest Florida International Airport  
SAN - San Diego International Airport  
SBA - Santa Barbara Municipal Airport (SDs)  
SJC - San Jose Mineta Int'l Airport  
SGR - Sugar Land Regional Airport  
TPA - Tampa International Airport

## PEER REVIEWS/EVALUATIONS

JFK - John F. Kennedy International Airport  
LAX - Los Angeles International Airport  
MCI - Kansas City International Airport  
MSY - Louis Armstrong New Orleans Int'l  
NRT - Narita International Airport  
PDX - Portland International Airport  
RDU - Raleigh-Durham Int'l Airport  
SFO - San Francisco International Airport  
SMF - Sacramento International Airport

## CONRACS

ATL - Hartsfield-Jackson Atlanta Int'l Airport  
BDL - Bradley International Airport  
BOS - Boston Logan Int'l Airport (SD Only)  
EWR - Newark Liberty International Airport  
PSP - Palm Springs International Airport  
TPA - Tampa International Airport

## AUTOMATED PEOPLE MOVERS

DFW - Dallas/Fort Worth Int'l Airport  
EWR - Newark Liberty International Airport  
IAH - George Bush Intercontinental Airport  
MCO - Orlando International Airport  
TPA - Tampa International Airport

## PARKING STRUCTURES

ATL - Hartsfield-Jackson Atlanta Int'l Airport  
AUS - Austin-Bergstrom Int'l Airport  
BDL - Bradley International Airport  
BUR - Hollywood Burbank Airport  
CLT - Charlotte Douglas Int'l Airport  
DEN - Denver International Airport  
DFW - Dallas/Fort Worth Int'l Airport  
EWR - Newark Liberty International Airport  
HOU - William P. Hobby Airport  
LGA - LaGuardia Airport  
IAH - George Bush Intercontinental Airport  
MCO - Orlando International Airport  
PAC - Albrook "Marcos A. Gelabert" Int'l  
PTY - Tocumen International Airport  
STL - Lambert St. Louis Int'l Airport  
TPA - Tampa International Airport

## ON-CALL SERVICES

ATL - Hartsfield-Jackson Atlanta Int'l Airport  
AUS - Austin-Bergstrom Int'l Airport  
BNA - Nashville International Airport  
HOU - William P. Hobby Airport  
IAH - George Bush Intercontinental Airport  
LAX - Los Angeles International Airport  
PSP - Palm Springs International Airport

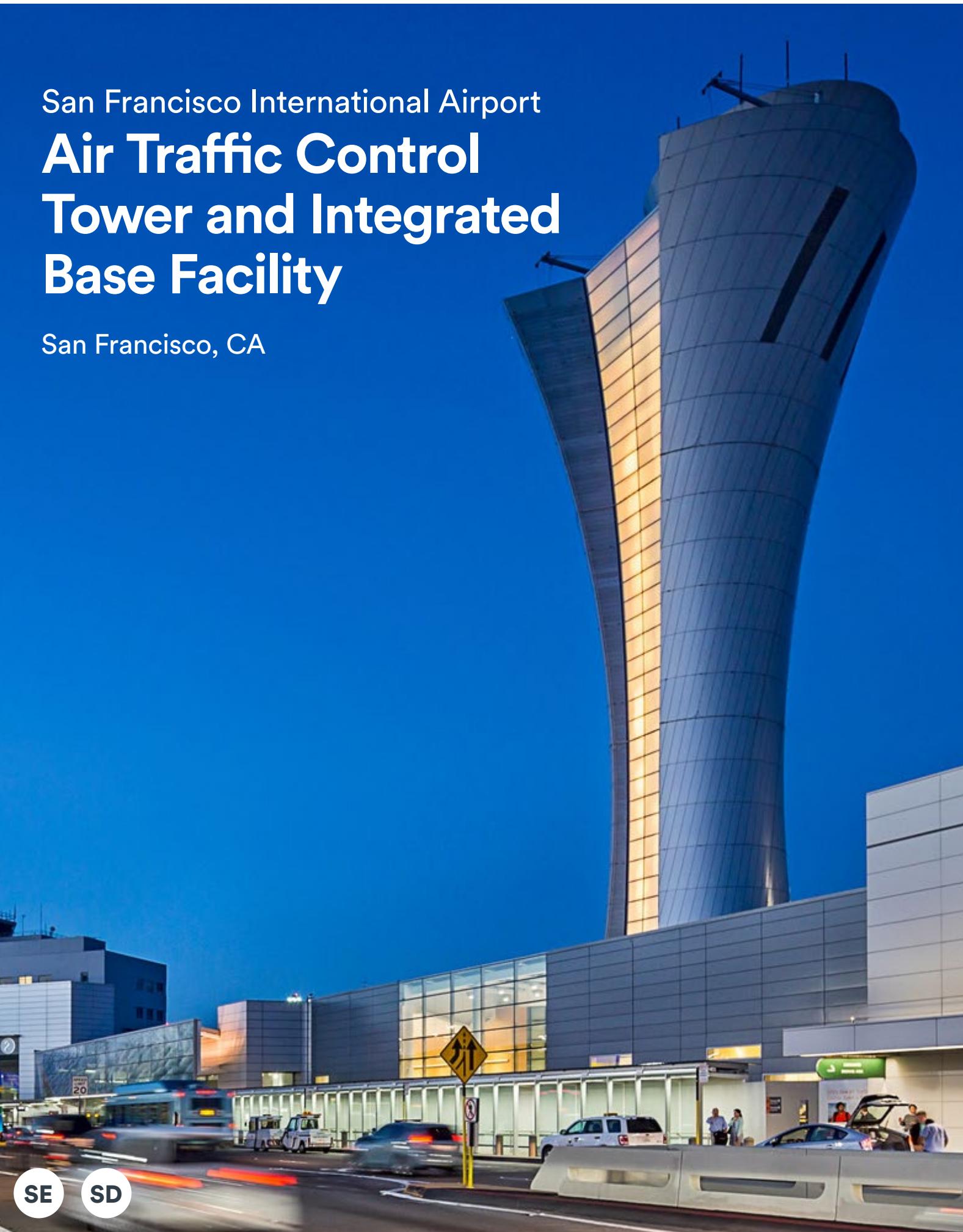
## BAGGAGE HANDLING SYSTEMS

ATL - Hartsfield-Jackson Atlanta Int'l Airport  
IAH - George Bush Intercontinental Airport  
LAS - Harry Reid International Airport  
LAX - Los Angeles International Airport  
PSP - Palm Springs International Airport  
TPA - Tampa International Airport



# San Francisco International Airport Air Traffic Control Tower and Integrated Base Facility

San Francisco, CA



SE

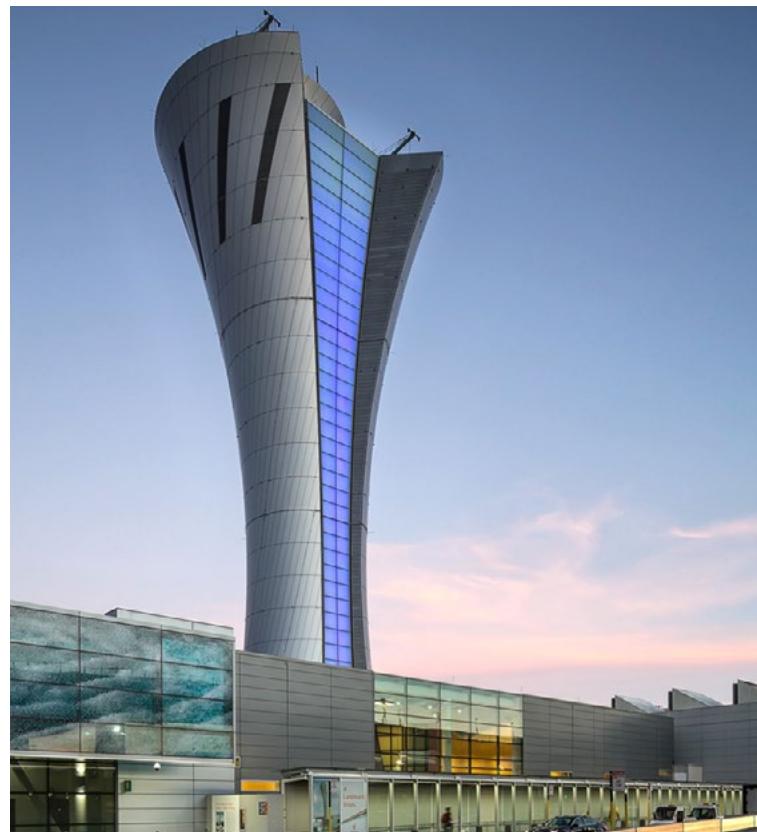
SD

“The SFO ATCT is truly a work of engineering excellence... We were very pleased with the skill and ingenuity that Walter P Moore brought to the structure. From the beginning, our goal was to build the best tower ever constructed, and the SFO ATCT delivered.”

— Geoffrey Neumayr, San Francisco International Airport

The Air Traffic Control Tower and Integrated Base Facility represent several firsts for the Federal Aviation Administration (FAA) — the first tower delivered with the airport in the lead using a design-build bridging documents package, and offering an observation cab with a 270-degree unobstructed view.

The tower's structural system, a cast-in-place reinforced concrete core cylinder, was selected employing performance-based seismic design. The tower was designed using vertical post tensioning to provide a self-centering action in the event of a major earthquake as well as a tuned mass damping system to mitigate accelerations due to wind. At the tower base, a three-story, 55,000-sf integrated base facility (IBF) serves as office and administrative space for both the airport and the FAA. It features office spaces, meeting rooms, wellness spaces and terminal space that provides a secure connection for passengers between T1 and T2.



The IBF incorporates blast resistant design along the roadway and performance-based seismic design. We performed a nonlinear time history response analysis with Perform 3D to verify that the expected behavior of the structure would meet the airport's performance objective of remaining operational at the maximum considered earthquake (MCE).

This is the first FAA tower delivered with the local airport in the lead; first FAA tower project using design-build delivery; and first FAA tower with a cab that has a 270 degree unobstructed view.

## SERVICES PROVIDED

Structural Engineering  
Secure Design

## OWNER

Federal Aviation Administration & San Francisco International Airport

## CONSTRUCTION COST

\$122 million

## COMPLETION DATE

2015

## PROJECT SIZE

55,000 sf integrated base facility

## SUSTAINABILITY

LEED Gold®

## AWARDS

ACEC 2016 Grand Conceptor Award Recipient

ACEC California Engineering Excellence: 2016 Golden State Award, 2016 Honor Award, 2016 Grand Award

SEAONC 2016 Excellence in Structural Engineering - Award of Excellence, Landmark Structures

IPI 2016 John L. Martin Partnered Project of the Year Award

ENR Regional Best Projects - Best Project, Airports/Transit

NCSEA Excellence in Structural Engineering Outstanding Project Award

DBIA Western Pacific Region: Design Excellence Award and Distinction Award

Airports Going Green - Chicago Department of Aviation Honorable Mention

# San Jose Mineta International Airport Air Traffic Control Tower and Base Building

San Jose, CA



SE EE SD

Located in the heart of Silicon Valley, San Jose Mineta International Airport (SJC) has grown to serve more than 12 million passengers annually since accepting its first commercial flight in 1949. In 2024, the Federal Aviation Administration (FAA) sought to replace the airport's aging air traffic control tower. Walter P Moore is providing integrated services for the new air traffic control tower, remote transmitter/receiver facility (RTR), and base building.

Due to SJC's proximity to several fault lines, the project required significant seismic performance goals. At 160 feet tall, the tower is designed at Risk Category IV. Walter P Moore's structural engineers performed a nonlinear time history response analysis with Perform 3D to verify that the structure's expected behavior would meet the FAA's performance objective of remaining operational at the Maximum Considered Earthquake (MCE).

Our enclosure engineering specialists are providing engineer-of-record services for the control cab glazing and enclosure consulting services for the air traffic control tower and base building. Walter P Moore's secure design engineers assisted the team in the implementation of government physical security requirements, resulting in an integrated and holistic physical security design for the new tower.

## SERVICES PROVIDED

Structural Engineering  
Enclosure Engineering  
Secure Design

## OWNER

Federal Aviation Administration

## COMPLETION DATE

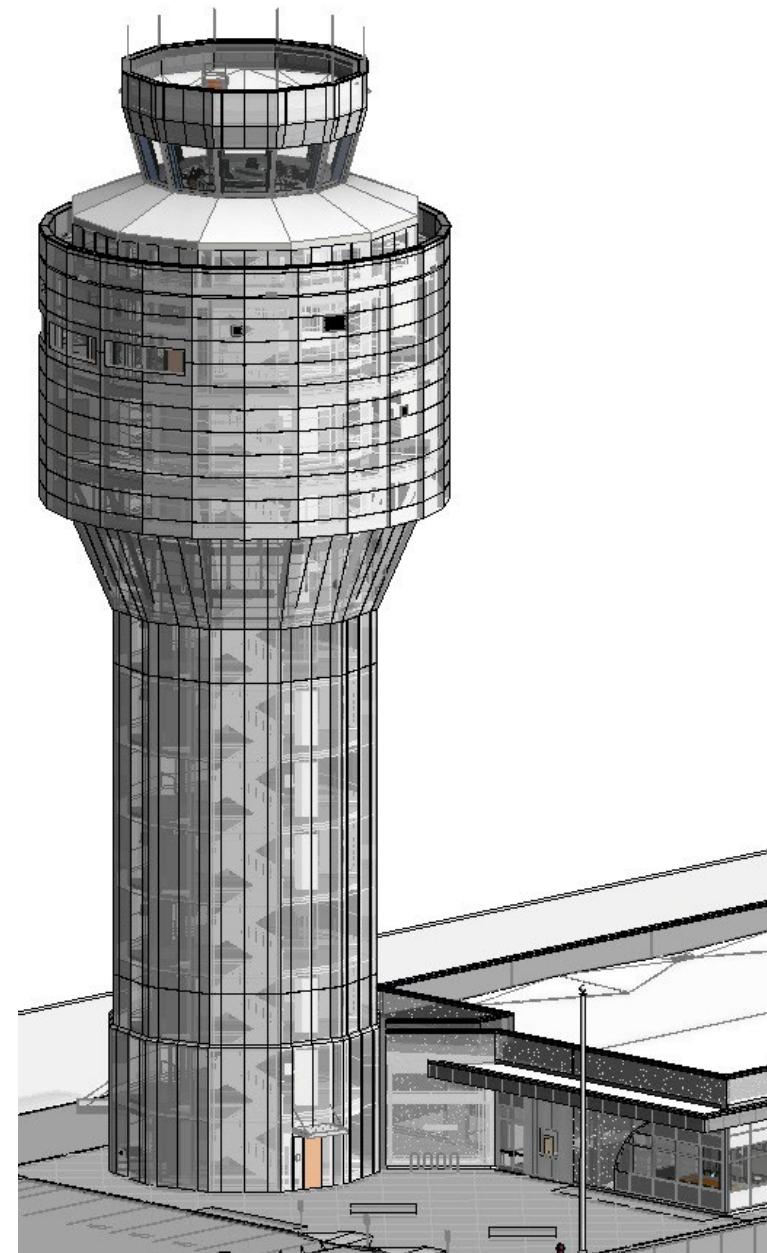
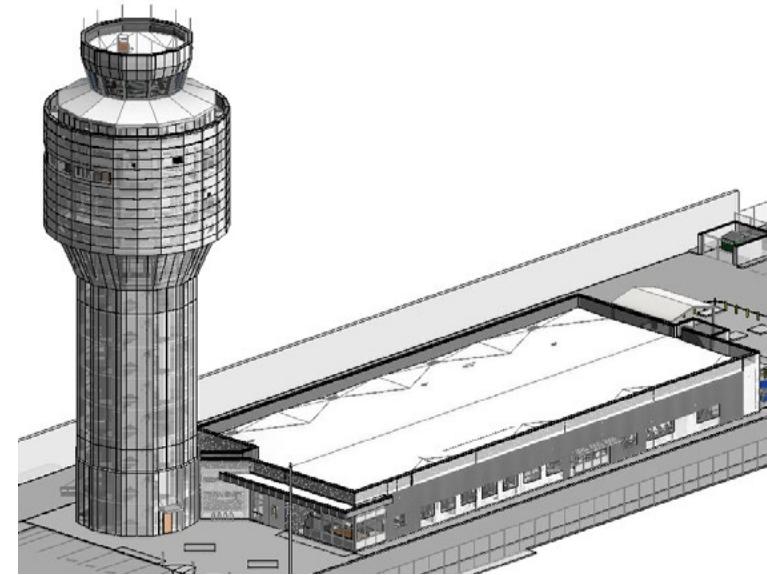
2027

## PROJECT SIZE

16,000 SF tower  
17,000 SF base building

## CONSTRUCTION COST

\$82 million



# Ted Stevens Anchorage International Airport Air Traffic Control Tower and Terminal Radar Approach Control

Anchorage, AK



SE

The Ted Stevens Anchorage International Airport Air Traffic Control Tower and Terminal Radar Approach Control facility will provide air traffic control for the airport as well as the world's largest seaplane base - Lake Hood Seaplane Base.

This new facility will serve at the center of the 5.7 million passengers and more than 3 million tons of cargo that move through the airport each year. The current tower, built in 1977 for four air traffic controller positions, has become inadequate due to airport expansions and increased cargo operations. To address overcrowding, and utilizing creative structural engineering solutions, the new ATCT will be more than 300 feet tall, nearly twice as tall as the existing tower – making it the tallest structure in Alaska.

Adjacent to the ATCT, is a 35,000-square-foot Terminal Radar Approach Control Base Building (TRACON) which will serve as a base for radar-approach operations, environmental, and administrative functions. The new TRACON prioritizes safety, sustainability, and operational efficiency, and includes floor plans optimizing maintenance and energy-efficient systems.

As a Risk Category IV building in a seismic zone, the ATCT design ensures structural stability for ANC staff in all conditions, recalling the 1964 earthquake that destroyed the original tower, subsequently rebuilt in 1977. The new design incorporates precautions for seismic risks, underscoring the facility's mission-critical purpose.



## SERVICES PROVIDED

Structural Engineering

## OWNER

Federal Aviation Administration

## COMPLETION DATE

2024

## PROJECT SIZE

35,000 SF

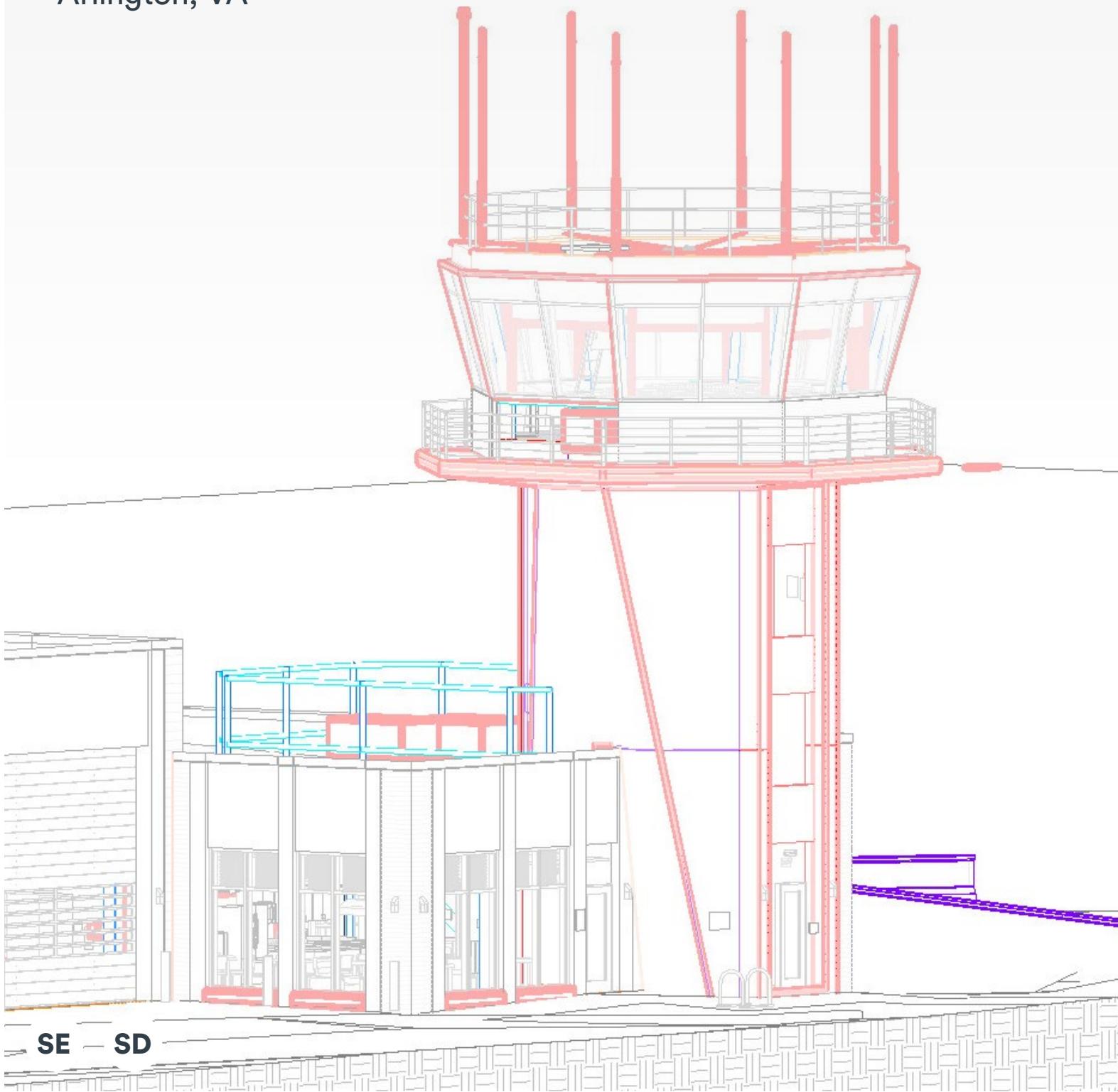
## CONSTRUCTION COST

\$110 million



# Pentagon Army Heliport Air Traffic Control Tower and Fire Day Station

Arlington, VA



Replacing a temporary facility in place for 20 years following the attacks of September 11, 2001, the Pentagon Army Heliport Air Traffic Control Tower (ATCT) represents a new standard of excellence for resilient high-security ATCT design. Walter P Moore developed innovative structural solutions to meet challenging subsurface conditions as well as stringent owner design criteria.

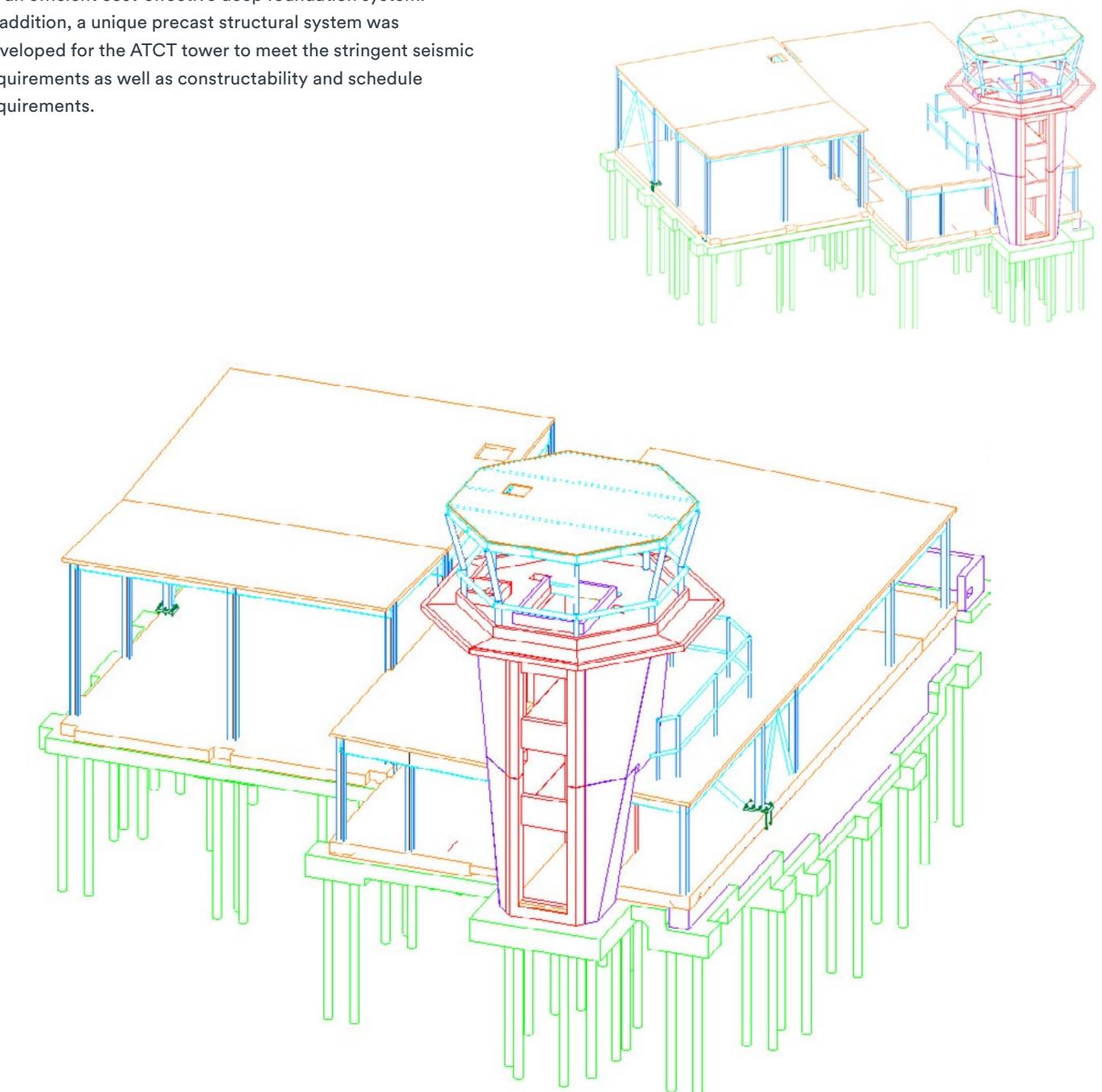
The ATCT and Fire Station structure consists of three discrete structures joined together to create a single functional program area. To address the presence of significant fill below the building pad that would have required complex excavation and special disposal procedures, the Walter P Moore team devised an approach to support the structure on an efficient cost-effective deep foundation system. In addition, a unique precast structural system was developed for the ATCT tower to meet the stringent seismic requirements as well as constructability and schedule requirements.

**SERVICES PROVIDED**  
Structural Engineering  
Secure Design

**OWNER**  
Department of Defense

**COMPLETION DATE**  
2025

**PROJECT SIZE**  
8,000 SF



# Memphis International Airport Air Traffic Control Tower

Memphis, TN

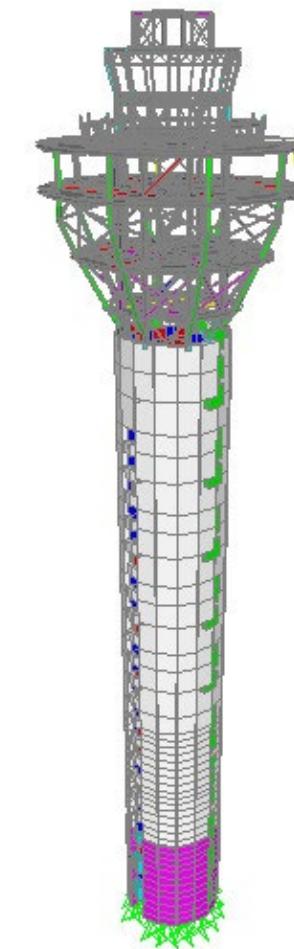


SE

Walter P Moore provided structural engineering services as a consultant to another firm for the design of the new Memphis Airport Air Traffic Control Tower (ATCT). The new tower was the third-tallest air traffic control tower at completion in the South, rising to a height of 325 feet.

Walter P Moore was engaged to do a performance based design, to verify that the structural system being used would meet the seismic requirements for the area. The pre-cast concrete tower shaft that was used by the Federal Aviation Administration (FAA) for similar ATCT's in the past was the preferred construction method for this tower; however, this system exceeded the height limit prescribed by the International Building Code (IBC) due to high seismic activity in the Memphis area and poor soil conditions.

Walter P Moore obtained seven time histories of previous seismic activities and scaled them to reflect seismic hazard for the project site. Non-linear analyses were performed to verify if the structure would have the necessary strength and ductility for seismic resistance. This alternative approach of performance based design is allowed by the IBC and the results of the analysis showed that the pre-cast concrete system would perform according to the design specifications and meet the intent of the code.



## SERVICES PROVIDED

Structural Engineering

## OWNER

Memphis International Airport

## COMPLETION DATE

2011

## PROJECT SIZE

325 FT tall



## Rafael Sabelli, PE, SE

Senior Principal, Director of Seismic Design

31 years of Experience

Rafael Sabelli, P.E., S.E. serves as the firm's Director of Seismic Design and oversees the seismic design of all Walter P Moore projects that include unconventional structural systems or reside in unusually high seismic locations. Mr. Sabelli has over 20 years of experience in the design of structurally-challenging projects located within high seismic regions, with a focus in the San Francisco Bay Area and surrounding areas.

### Education

Masters of Science in Civil Engineering,  
Structural, University of California,  
Berkeley, 1993

Masters, Architecture, University of  
California, Berkeley, 1992

### Registrations

Licensed Professional Engineer  
California 58632  
Oregon 93089

Licensed Structural Engineer  
California 4553  
Washington 47300

### Affiliations

American Society of Civil Engineers  
Key Member ASCE-7 Seismic Subcommittee

American Institute of Steel Construction  
Vice Chair Task Committee 9  
Chair Seismic Design Manual Committee

Structural Engineers Association of  
California Past President

Structural Engineers Association of Northern  
California Past President

Structural Engineers Association of Southern  
California Chair AISC/SEAOC Joint ad-Hoc

Task Group on Development of Building  
Code Provisions for Buckling-Restrained  
Braced Frames

Past Chair Seismology Committee

Building Seismic Safety Council Provisions  
Update Committee

National Structural Engineers Association Past  
Member Seismic Code Advisory Committee

### Awards

2021 AISC Lifetime Achievement Award



**Tim Santi**

Sr. Principal | Aviation Market Leader  
404.304.0073  
tsanti@walterpmoore.com

**Justin Jacobs**

Principal | Federal Business Development Manager  
202.478.1472  
jjacobs@walterpmoore.com