

MANAGING HANGAR CONSTRUCTION FROM START TO FINISH



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Taken at face value, hangars seem fairly simple—garages for airplanes. But when it comes to building them, the job is much more complex than simply designing and constructing a warehouse big enough to put aircraft inside.

The Korte Company's Design-Build approach has served us well on several hangar construction projects for both civilian and military customers. Each job was unique, and we came away with some important lessons learned.

We've used those lessons to compile this guide to hangar construction management.



PRE-CONSTRUCTION CONSIDERATIONS

Because hangars are almost always built on active airports with frequent air- and land-based traffic, successful hangar construction is the art of staying out of the way.

The important activity at high-volume commercial airports or military air bases can't just be stopped without serious consequences. Construction projects must be as minimally invasive as possible.





But even with an appropriate construction site chosen, contractors and airport managers need to coordinate closely from the start and answer some important questions, including:

- How long will the project take? How will its phases be implemented?
- Will construction directly interfere with incoming or outgoing air traffic?
- How close will the construction site be to neighboring structures?
- Will construction obstruct any rights of way for ground vehicles?
- What applicable FAA rules or military guidelines will impact the project?
- Will additional site security measures affect the personnel, vehicles, tools or supplies brought to the site?
- Will nighttime construction restrictions impact the project?





The answers to these questions may mean some creative planning is in order, and that's something best done long before groundbreaking. For instance:

- The contractor may be required to use different construction equipment or techniques if the job site is too close to incoming or outgoing air traffic.
- If the job site is in close quarters with other structures, there may be limited lay-down space. Supplies and equipment may need to be kept off-site until needed and deliveries must be phased carefully.
- Airports and bases cater to aircraft, but they're still hubs of activity for ground-based vehicles like freight and fuel trucks, baggage carts and emergency vehicles. Managers and contractors must devise alternate routes if the project will cause blockages of these important pathways.
- The Federal Aviation Administration (FAA) has published rules that impact the way hangars are built and used on most airports. The military branches have additional guidelines that must be met. Airport managers or commanding officers and contractors must work together to ensure the applicable rules are met. We discuss regulatory considerations in more detail in a later section.
- Airports and military air bases are secure areas. It's as much about what items are allowed on-site as it is about who is allowed and how they're accounted for. This requires additional planning.
- Contractors and airfield managers need to plan for how work can progress during nighttime hours when visibility is low. Cranes may need to be rigged with high-visibility flags and additional lights—or they may need to be taken down altogether.



HANGAR CONSTRUCTION COSTS

It's difficult to compare the cost of a hangar to that of other large, open buildings because they serve such a unique purpose. Warehouses might come close in form, but the cost to build a hangar is largely driven by the unique nature of its function. Here are some key cost drivers:

Hangar floors – Floors must be designed to sustain heavy loads for long periods of time. High-performance concrete that can sustain the weight of a fully-loaded 300,000-pound Air Force tanker across just a few wheels may be required. What's more, if any maintenance or repair work involving corrosive chemicals is completed in the hangar, its floor should be coated to protect against degradation from chemical attack. That coating should also be strong enough to resist wear from constant impact by planes or other equipment.





Utility infrastructure – Getting a hangar hooked up to utilities and installing climate control is an enormous job. Hundreds of miles of conduit and wiring is required to ensure all internal electrical needs are met. Fire sprinkler systems need to be robust enough to effectively douse a hangar's massive interior space. HVAC systems need to be strong enough to keep temperatures inside the hangar comfortable. Additional piping and pumping equipment may be necessary if the hangar will be equipped with fueling capabilities.

Hangar doors – More than merely a glorified garage door, the components that comprise hangar doors must be big enough to allow that fully loaded Air Force fuel tanker to enter and exit with plenty of clearance. A door that size requires components strong enough to lift and lower it over and over.



Construction materials – High-quality, fire-resistant shaped metal and high-performance concrete are among the critical materials needed for hangar construction. The materials —as well as the foundation— must be strong enough to support the weight of a massive hangar roof as well as the hangar's main doors.



COMMON ISSUES DURING HANGAR CONSTRUCTION

There are a few important issues and considerations unique to hangar construction that contractors must account for to ensure a successful delivery.

The most important of these is the need for construction and airport workers to remain in close contact. Because airports and bases remain active during hangar construction, a complex choreography plays out between airport and construction crews that must be planned well in advance. Just as air traffic controllers keep aircraft movements running smoothly, construction managers are similarly responsible for their personnel.

Contractors also need to make certain level grade is maintained throughout the worksite and inside a hangar. This is important on any site for any vehicle, but it's especially crucial along paths traversed by aircraft with sensitive and expensive engines suspended just a couple feet above the ground. Tolerances and specifications for concrete installation are extremely tight.





Another important consideration during hangar construction is controlling foreign object debris (FOD). FOD is anything on a runway or taxiway that can be sucked into aircraft engines. Even the smallest pebbles or bits of plastic can cause severe damage if they make contact with the internal workings of an aircraft engine. That's why strict precautions are often put in place to prevent FOD, some of which include:

- Any vehicle entering a construction site is stopped and thoroughly checked to ensure any loose or hanging components are removed or tied down. Tires are sprayed to dislodge any rocks or other debris picked up from outside the site.
- Street sweepers are constantly operating near construction sites to ensure the ground stays free of debris.
- Tool check-ins may be mandated to ensure all tools and parts are accounted for at the end of a day or shift.
- Cleanup control measures may be enforced so that no discarded packaging or unneeded materials end up on a taxiway or runway. These measures could include requiring covered dumpsters or the removal of trash via closed trailers.



REGULATORY STANDARDS FOR HANGAR CONSTRUCTION

Like any other construction job, hangars are subject to local statutes and permits governing new construction. However, there are additional rules unique to these projects.

The FAA strictly enforces rules about how high hangars or other support buildings can be built, the type of lighting used on or near airport structures, acceptable hangar door clearances, aircraft tie-down design and site security, among other things. The Administration has also published rules regarding how hangars can and cannot be used at airports that accept federal aviation grants. [These rules](#) may affect the way a hangar is designed and built.

Military hangars are held to separate standards compiled in the [Unified Facilities Criteria for Airfield and Heliport Planning and Design](#), which spell out all technical aspects pertaining to the planning, design, construction, operation and maintenance of hangars designed for military use.





CASE STUDY: HANGAR CONSTRUCTION AT TINKER AIR FORCE BASE

A hanger we built a few years back at Tinker Air Force Base in Oklahoma City exemplifies all the unique facets of a hangar construction project.

The 164,000-square-foot hangar is longer than two football fields end to end (675 feet, to be exact) and is 239 feet wide. Plus, we built a free-standing three-story office space inside it. Here are some of the challenges we met head-on:





A BIG, FLAT FLOOR

With a hangar that big, you need a lot of concrete. We're talking on the order of 1,900 truckloads of it. As described above, dramatic grade changes are a recipe for disaster. Total grade change across the whole Tinker AFB hangar floor is just half a percent. After shot steel blasting the floor twice to prepare it, 1,600 gallons of epoxy coating was applied to protect it against repeated impact and any chemical damage.



ANCHORING THE BUILDING

Serious hardware is required to keep a massive hangar anchored to the ground. Ninety-four steel-reinforced concrete piers ranging in diameter from two to four feet were installed between 40 and 60 feet into the earth. Then, we buried hundreds of eight-foot-long anchor bolts into the piers. The hangar isn't going anywhere.

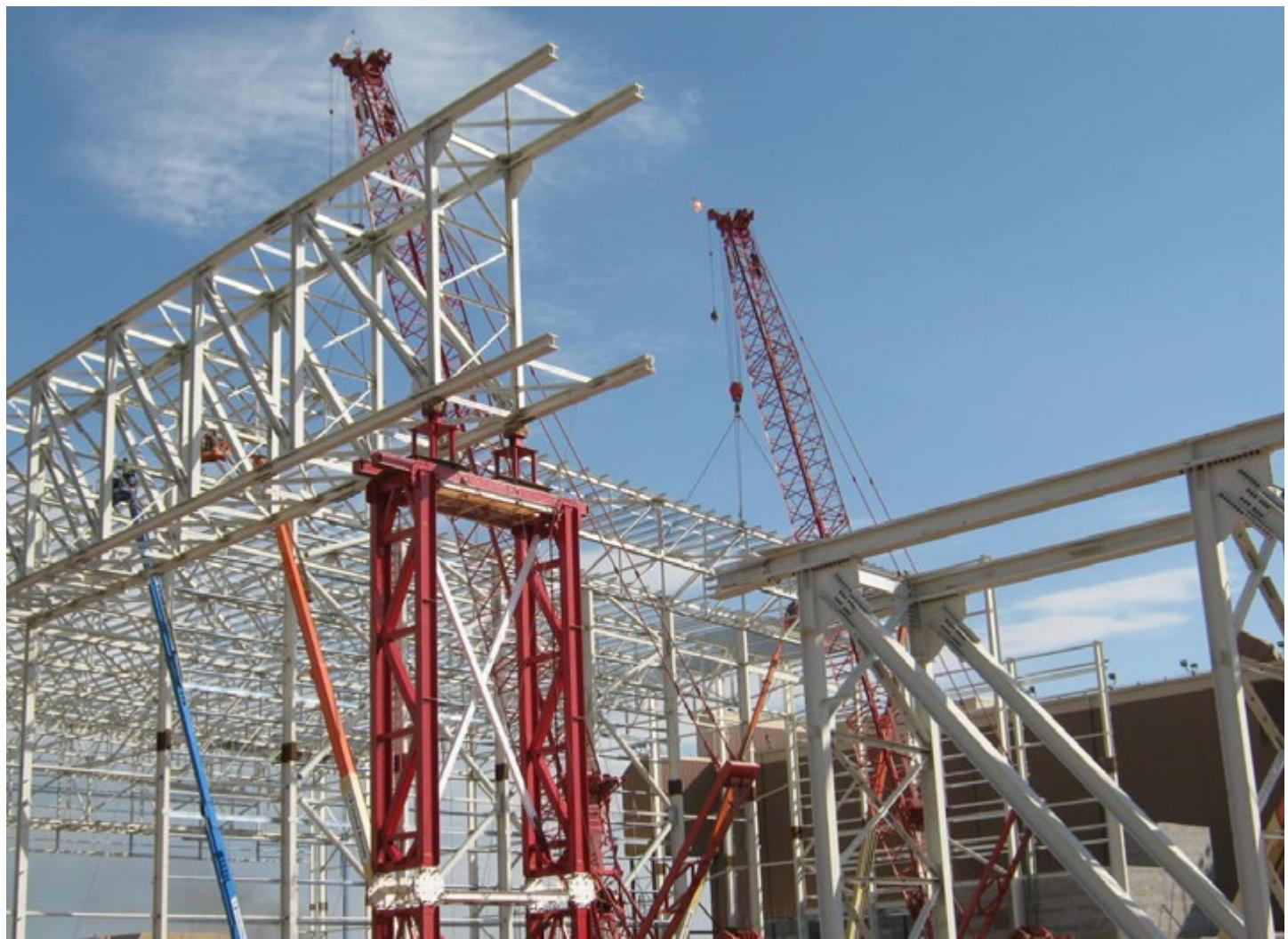




INSTALLING THE DOOR

The main doors at the Tinker AFB hangar are huge. One is 218 feet across and the other is 428 feet across. The larger of the doors was so expansive we had to use three 80-foot tall structural bridges to heft its header into place in four separate pieces. Here's how we did it:

The first piece of the header was set to an existing stanchion and spanned to the first structural bridge. Then the second piece was lifted into place and spanned the distance between the first and second bridge. The third piece was lifted and set into place onto the second and third bridge. The final piece was then set and spanned from the third bridge to the other existing stanchion.





FOD CONTROL

Airfield managers mean business when it comes to FOD control. It started with an intensive FOD control training course our workers completed before getting started. The following precautions were taken during construction:

- Only covered dumpsters were allowed on the site so that discarded materials wouldn't ride a frequent Oklahoma wind gust into the path of any aircraft.
- One worker's main job was to run a street sweeper around the construction site while another painstakingly hosed off every single tire of every single vehicle that entered the construction area.
- A check-in system to account for every tool brought to the site was adopted to eliminate the risk of missing tools becoming FOD.
- Prior to engine startup, airmen drove around planes with a large magnet that would attract any metal objects near a plane.
- Even portable toilets were anchored to the ground.



OTHER HANGAR CONSTRUCTION JOBS

We're seriously proud of our work at Tinker AFB, but we hang our hard hats on more than just that one job. Consider these other hangar construction projects we've delivered across the U.S.:

- **Naval Air Station Whidbey Island, WA** – [Our work](#) included a full modernization and the addition of 7,000 square feet of space each to two maintenance bays in Hangar 6 and an extension of Hangar 9. We also managed the overhaul of the site's 55-year-old [Hangar 5](#).



- **U.S. Customs and Border Protection, Oklahoma City, OK** – [This project](#) included the construction of 41,500 square feet of aircraft support space and 26,000 square feet of additional maintenance shops and offices.





- **Luke AFB, AZ** – [The hangar](#) clocks in at 18,740 square feet and is designed to house four F-35 aircraft. The structure also includes a tool room, break rooms and lavatories.
- **Midcoast Aviation, Sauget, IL** – [The 40,000-square-foot hangar](#) can house commercial-size airliners. It's the second such hangar we've built at the St. Louis Downtown Airport right in our back yard near St. Louis.

HANGAR CONSTRUCTION WITH THE KORTE COMPANY

Hangar construction requires intense pre-planning, strict adherence to rules during construction and a commitment to flexibility and communication with the personnel with whom you share work space. To get these jobs right, we've hit the books and have had boots on the ground time and time again.

All those jobs on our resume is proof that airfield managers and military leaders across the country trust The Korte Company to deliver these critical structures on-time, on-budget, every single time. If you're planning to build a new hangar and want to learn more about what we bring to the table, [tell us about the job](#).

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