



CANADIAN CONSULTING
ENGINEERING AWARDS 2020

WESTJET WIDE BODY HANGAR AT CALGARY INTERNATIONAL AIRPORT

Category: B TRANSPORTATION



← Though traditional in its design and structure, the WestJet Hangar can accommodate one of the largest planes in the commercial airline industry.

PROJECT SUMMARY

WestJet required a wide-body hangar at the Calgary International Airport to accommodate their growing fleet of 787 Boeing Dreamliner planes. Stantec provided structural, mechanical, electrical, and civil engineering in addition to the architectural design. Stantec's design for the building allows WestJet to service their fleet of 737's and increase the 787 fleet by 200 percent. Taking advantage of a wind engineering study, the wind loads were reduced and decreased the steel tonnage by 10-15 percent.



INNOVATION

Stantec provided full engineering services in the design of WestJet's new wide body hangar at the Calgary International Airport. The new hangar allows WestJet to add new overseas destinations and become a true global competitor.

Standing at 24m (80 feet) tall and having a clear span of 75m (246 ft) the hangar encloses over 11,600m² (125,000 ft²) of floor space. Two innovative solutions were provided to reduce costs and materials.

The standard wind loading code classified the structure as a 'high-rise' building as the roof height is greater than 20m (66 feet). As an alternative, Stantec recommended the use of wind tunnel testing to determine precise wind loads rather than rely on the simplified figures in the code. CPP Wind Engineering performed wind tunnel testing of a 1:350 scale model that utilized the actual site conditions to determine accurate wind loads on the structure.

By conducting the wind engineering study, we safely reduced the wind loads from those required by code. This provided a more efficient and sustainable hangar design by decreasing the steel tonnage by 10-15 percent.

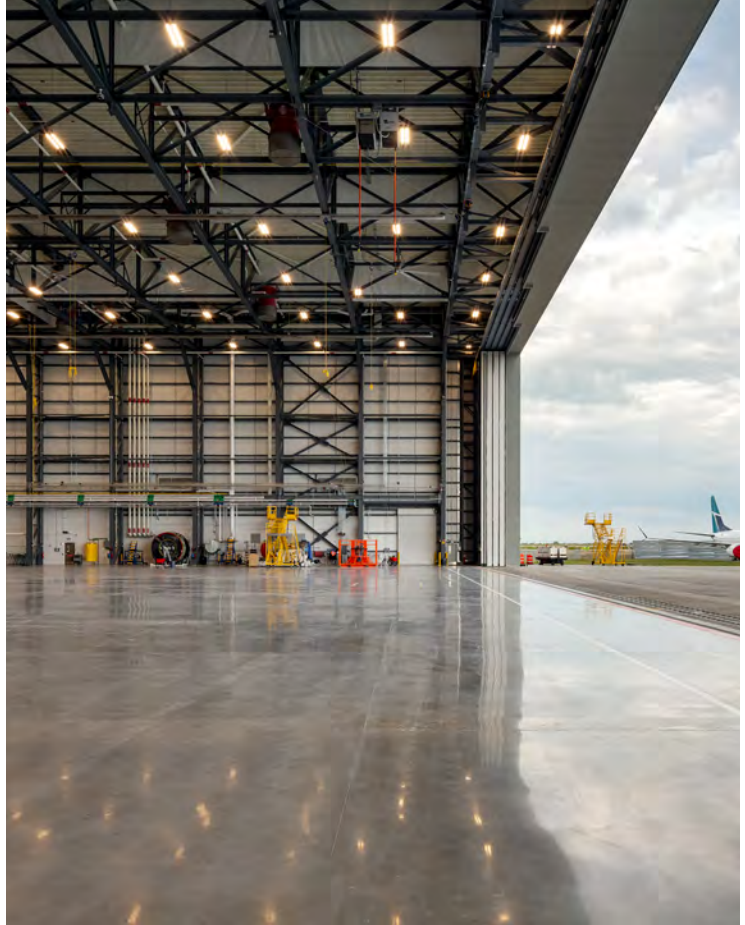
Another unique structural feature is the use of long span steel decking for the roof which eliminated the need for joists between the primary steel frames.

As this deep profile roof deck is not currently available in Canada, it was sourced from the United States. The use of this profile is likely to set a precedent for future large span roof structures in Canada – it provides the required strength and effectively combines the typical Open Web Steel Joist (OWSJ) and conventional roof deck approach in one system.

As each 8m (26ft) long deck section came in a narrow width 400mm (16in), traditional installation methods need-ed to be adjusted. Rather than work with a bundle of roof deck dropped over closely spaced joists as is common practice, the installation crews needed to work from both ends of the 8m space between the main structural truss frames to bring each deck panel into place. Once enough width of roof deck was in place, deck installation could proceed like traditional approaches.

With an area larger than three football fields, the new WestJet hangar at the Calgary International Airport is the only place that WestJet can service their 787 planes west of Toronto.

The design of the doorway is a bi-parting system with standard six panels divided down the middle and which slide into individual door pockets. However, the doorway is massive: 19m (62ft) tall by 70m (230ft) wide!



COMPLEXITY

The size of the structure created three major challenges for our team to overcome

The first; designing a massive door that's 19m (62ft) tall by 70m (230ft) wide. Stantec completed the structural design rather than delegating the design to a fabricator. This allowed us to precisely control the complex design. Stantec worked in collaboration with a steel fabricator and CANA Construction to properly and safely install the door.

The second; access to mechanical and electrical systems with a 24m (80ft) ceiling height. Traditionally, a hangar's mechanical and electrical systems are hung from the ceiling; however, the height of the hangar would make maintenance of these systems a strenuous and hazardous job. Instead, our mechanical and electrical teams ran a service rail at a lower level around the building that holds piping and conduits for easier access. Additional connections are also made at this service level readily allowing adjustment to future system needs.

The third; incorporating requirements from the aircraft maintenance industry. The Ground Power Units (GPUs) needed to be strategically placed in order to power the various aircrafts while in service. Typically, GPUs are located at ground level, but because this hangar needed to accommodate a range of aircraft sizes, the Stantec team designed GPUs that hang from the ceiling. These are operated via a ground level control panel and motorized cable reels.

Through continuous and clear communication between the Stantec team, WestJet, and the specialty consultants, we were successful in responding to these challenges.



SOCIAL AND ECONOMIC BENEFIT

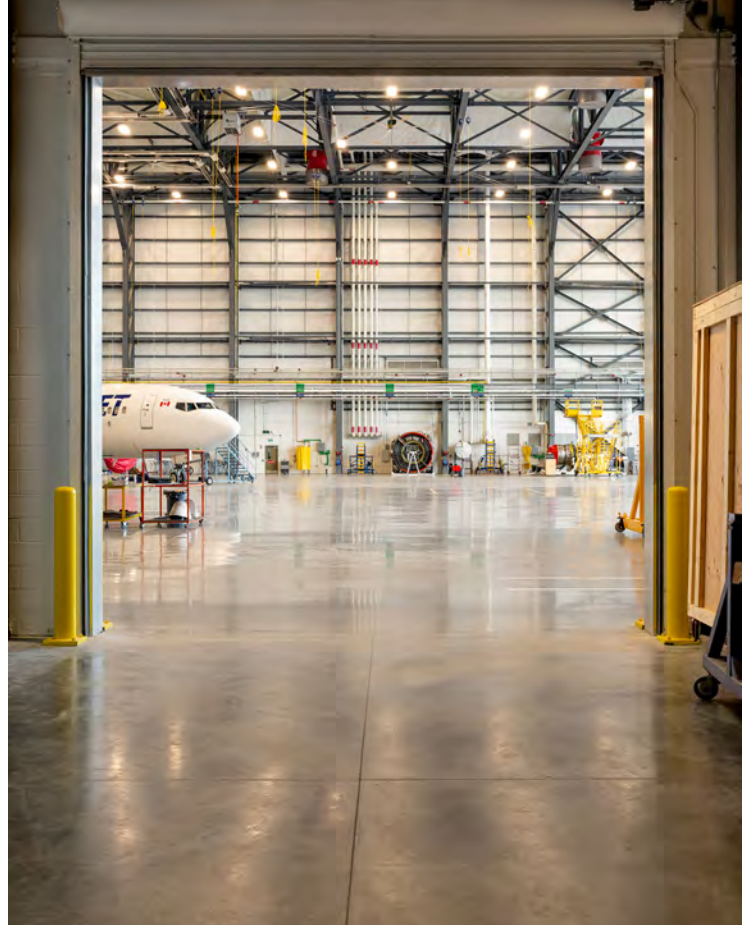
WestJet is the largest carrier based out of the YYC Calgary International Airport and has been a major economic driver for the city. The new facility allows WestJet to accommodate global, long-haul flights while increasing their ability to provide quality maintenance on their growing fleet. WestJet continues to remain the airline with the most destinations, seats, and departures out of YYC, and the construction of the hangar will cement this position for years to come.

WestJet's investment in the hangar has solidified the Calgary International Airport as a Canadian travel hub and shows WestJet's commitment to its hometown. In addition to providing over 300,000 person hours of economic contribution to the local economy, it will also provide significant new jobs for WestJet. Moving forward, the hangar marks the next step in WestJet's evolution as an international airline, providing thousands of direct and indirect jobs, elevating their brand reputation, and providing an attractive market for investment in Calgary.

The new hangar gives WestJet the option to grow with the changing needs of the travel industry. With the ability to accommodate an aircraft of this size, WestJet has expanded their marketing efforts towards premium and business travelers—providing them with an unforgettable, luxurious experience.

WestJet is on track to take possession of ten more 787 Dreamliners by 2021, with an option to buy an additional ten in 2024. With the new Hangar allowing WestJet to become an international carrier, they can now compete with Air Canada in the global market.

While everyone was focused on schedule, the team was also cognizant of cost impacts for each design & construction decision. Careful decisions as to equipment and material selections were made each day to keep the project within the 50-million-dollar budget.



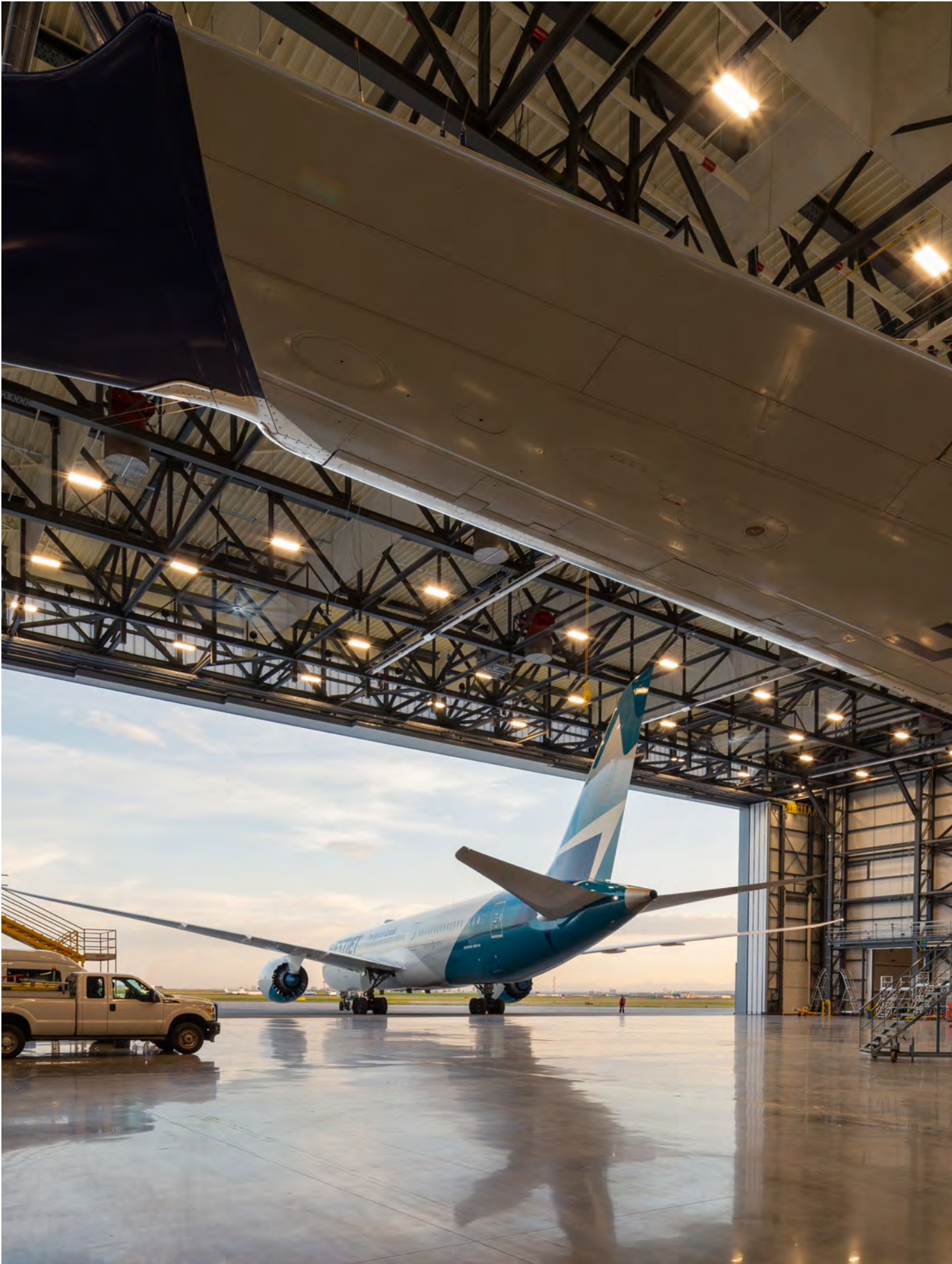
ENVIRONMENTAL BENEFIT

The WestJet Hangar addresses environmental/sustainable issues in two main ways. The first is in the design and construction of the hangar, and the second in supporting operational improvements in the airline industry.

The design of the hangar was largely based off the typical design for smaller aircraft hangars. Its difference: however, is its massive size that categorizes the hangar as a high-rise building. By conducting a wind engineering study, we were able to optimize the code requirements and safely reduce steel tonnage by 10-15%. The building envelope and mechanical systems are designed to more recent energy codes, thus saving approximately 15% of annual heating costs.

On an operational level, the new hangar provides a hub for long haul flights out of Calgary. Customers are now privileged to select direct flight to a multitude of international locations without having to travel to Toronto where other 787 aircrafts are serviced. The new hangar ultimately creates more efficient travel for customers and provides a long-term reduction in global greenhouse gas emissions.

The 787 is one of the most fuel-efficient aircraft in the world. As air travel continues to increase, environmental impacts can be minimized by reducing the average age of a fleet. 787's use up to 35% less fuel per passenger per distance travelled than similar aircrafts that may be 15 to 20 years old. Newer airplanes also produce less noise during take-off and landing, thus allowing for more frequent operation over urban environments and reducing the effect on nearby residents and wildlife.



- ← The first scheduled flight in the new Dreamliner was set for departure from the Calgary International Airport on April 28th, meaning everyone had to work quickly to ensure the hangar was complete and ready for proper service before takeoff.

MEETING THE CLIENTS NEEDS

The client's desired a hangar that would allow for flexible servicing of ten new 787 aircraft and their existing fleet of 737 aircraft while adhering to a strict schedule and budget.

Flexibility was an important factor in meeting the clients servicing goal for their aircraft. The hangar was designed to hold and service one 787 aircraft or four 737 aircraft. Because of this need, careful placement consideration of Ground Power Units (GPUs) was needed. GPUs were hung from the ceiling to allow for easy access by technicians no matter the size of the plane. Hanging the GPUs also mitigated any tripping hazards and unnecessary labor of manually moving cables across the floor.

Maintaining the schedule was another indicator of successfully meeting the client's goal's since the hangar had to be 100% completed before the arrival of the new fleet of aircraft on April 28th, 2019.

This schedule risk was mitigated by choosing a sequential tendering process. The foundation piling and primary steel structure were tendered long before the final architectural plans were complete. To reduce the potential that components already in construction needed to be modified to accommodate design changes, Stantec's architectural team needed to prioritize their design decisions based on their construction impact. This required close collaboration with the engineering teams to strategize solutions for potential difficulties or possible schedule delays.

By collaborating with the client, contractor, and sub-consultants, we were able to successfully meet the client's goals.