

As the 6th busiest airport in the United States in 2016, Denver International Airport (DEN) has announced several projects intended to further increase the airport's traffic counts, while improving the passenger experience. On an average day, DEN's train system delivers approximately 16,000 passengers to Concourse C alone, a number which is expected to increase in coming years. Meanwhile, Colorado's status as a world-premiere destination will continue to attract travelers to the Mile High City via DEN, putting additional strain on the airport's conveyance systems, including the escalators serving passengers between the Automated Guideway Transit System (AGTS - "the train") and concourse levels.

Due to already-increased foot traffic, the current 25-year-old escalators are subject to daily shutdowns. Constant mechanical maintenance defeats the purpose of efficiency the units were designed to supply. At the same time, shutdowns aggravate passengers and take away from their seamless travel experience.

Specific to Concourse C, home to Southwest Airlines, eight escalators transport passengers between the train and concourse levels and are split between the north and south ends of the concourse. DEN tasked Swinerton Builders to remove four escalator units from the north end and replace them with eight new ThyssenKrupp (TKE) units in six months. *Swinerton faced pressure to complete the project on schedule* as DEN had awarded a similar scope to a different team in the prior year. That attempt achieved only four units being installed in 11 months, a situation that left DEN with unanticipated and lingering maintenance issues.

Wanting to meet DEN's schedule requirements, the Swinerton team operated with a commitment to nothing less than complete transparency and a 100% commitment to timely communication, measured by Key Performance Indicators of on-time and on-budget delivery, no safety incidents, and partnership between Swinerton and all DEN stakeholders. Ultimately, Swinerton successfully *removed the four old escalators and set eight new ones within the first three months of a six-month schedule, with the entire project turning over to DEN one week early with no safety incidents!*

Significant pre-planning and coordination efforts among several DEN stakeholders, including Southwest Airlines, Security, DEN Planning, Operations, and Maintenance Control departments, the project's neighboring tenant Xpress Spa and TKE, resulted in this outstanding performance.

Special Circumstances Solutions

Any escalator replacement project in an occupied building presents a myriad of challenges, but *layer in the unique circumstances of working in a continuously operational airport*, and three main challenges appear:

- Coordination with the airlines to schedule tasks that call for gate shutdowns
- Delivering and receiving of materials via airside roadways while avoiding aircraft, baggage claim and operations traffic
- Working alongside different stakeholders and tenants to ensure adjacent businesses can operate to full potential while areas around them are under construction

The timing of airport concourse construction work remains at the mercy of the airlines. For this project, Swinerton used an existing glass sliding door at a Concourse C gate to hoist out the four 18-ton escalators and bring in eight new ones, and all the associated equipment needed to facilitate this project such as a gantry crane, scissor lifts, hoist and track man lift. Since Swinerton had the equipment delivered along airside roadways, *flexibility and communication ruled more so than usual during the 25 nights that Swinerton used this door to bring materials in and out of the building*. The airline shut down our operations once for the night-shift work due to a weather-delayed flight needing to use this particular gate; a handful of other times Swinerton's work was paused for a few hours due to the airline's using the gate.

Moving an 18-Ton Escalator through DEN

As an escalator unit was removed from its fastenings holding it place, Swinerton hoisted it with a twin 20-ton gantry crane onto dollies placed on the concourse. Sometime between midnight and 3 A.M., 12 people pushed each 18-ton escalator 100 yards through Concourse C

and to the 7'0 x 6'0 sliding glass door gate opening, through which the escalator barely fit and required constant readjusting and repositioning, all while protecting the existing concourse finishes. Once at the opening, the team responsible for connecting the escalator to the crane hook guided the equipment out of the opening without having a single body part cross the plane of the opening due to FAA regulations for airside security, and onto a waiting flatbed truck. For new installations, the process was reversed. ***In total, we estimate each person pushed around 3,000 pounds 12 times in the removal and installation process.***

Admittedly, the team created efficiencies over the course of the removal and installation process which helped in turning over the project to DEN one week early. There was a ***definite steep learning curve as the first escalator removal took three hours; the last installation took 28 minutes - that's a 84% efficiency improvement.*** In all, the project required 14,000 manhours in which zero safety incidents occurred due to Swinerton's diligent 100% on-site dedicated safety manager who worked closely with DEN's safety director to meet the airport's rigid safety protocols.

Working in a 24/7 Operational Airport

Swinerton's noisy-work hours were 9 P.M. to 5 A.M. – times which coincide with little to no flight traffic. Over the course of six months, Swinerton and subcontractors worked 80 shifts of night work, and 70 shifts of day work, of which 90 shifts overlapped. To facilitate the removal and installation of the escalators, Swinerton widened the concourse level and escalator pit, which contains the motors and electrical panels to operate the system, by six feet on one side. Demolition work also included removal of a four-foot concrete stem wall and a cantilevered slab for the installation of new structural steel on the AGTS, apron and concourse levels to support the new escalator units and handrails.

A scaffolding system installed under the escalators facilitated construction activities and protected passengers from overhead dangers on the AGTS level who walked under our

work zone to provide a safe egress path. On the concourse level during construction, we installed handrails around the perimeter of the work area for *fall protection and installed four horizontal life lines as the site presented a 33-foot change in elevation.*

To facilitate the removal and installation of the escalators and associated demolition and new finish work, Swinerton encased the three levels of the work in temporary partitions to maintain separation from airport users and to contain dust during demolition activities. The partitioned area also provided Swinerton a work and laydown space of 1,925 square feet on the concourse level.

During the day, Swinerton worked quietly behind the scenes as passengers used the train and walked to their gates on the concourse level, unimpacted of the work behind the partitions. The tenant adjacent to the site was a massage spa where passengers went to relax before their flights. Absolutely no site, sounds or smells could emit from behind the partitions during the airport's busy hours. Swinerton is proud of the fact that only one complaint was made about a smell emitting from welding operations early in the project. That situation was quickly remedied and no further complaints were made.

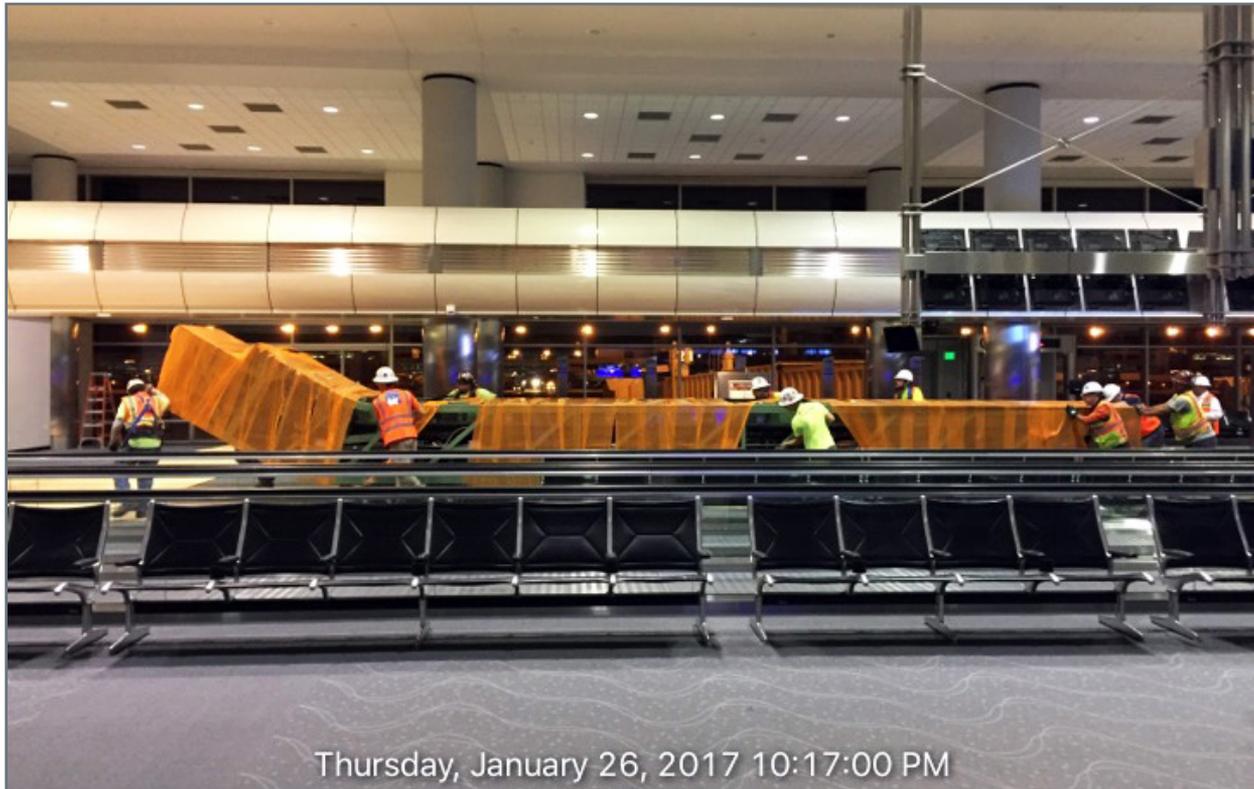
During night shifts, Swinerton moved the partitions out of the way to expand their area so they could work safely and efficiently. Then, around 4 A.M, they began the process of putting things back in place and making the area tidy so the next day at DEN could begin without surprises from Swinerton.

Client Service

As a nod to DEN's approval of Swinerton's work, DEN did request that Swinerton bid the next phase of escalator replacements on Concourse C. As of August, that project is underway with a targeted completion of January 18, 2018, - one date that Swinerton is certain to meet through committing to nothing less than complete transparency and 100% timely communication.



Top Photo: New escalators installed one week early
Bottom Photo: DEN passengers walk by the Swinerton site safely enclosed behind temporary partitions with wayfinding messages



Top Photo: Nightshift work with the partitions moved out of the way

Bottom Photo: Twelve workers push the 18-ton escalator through Concourse C to where it will be hoisted out of the airport

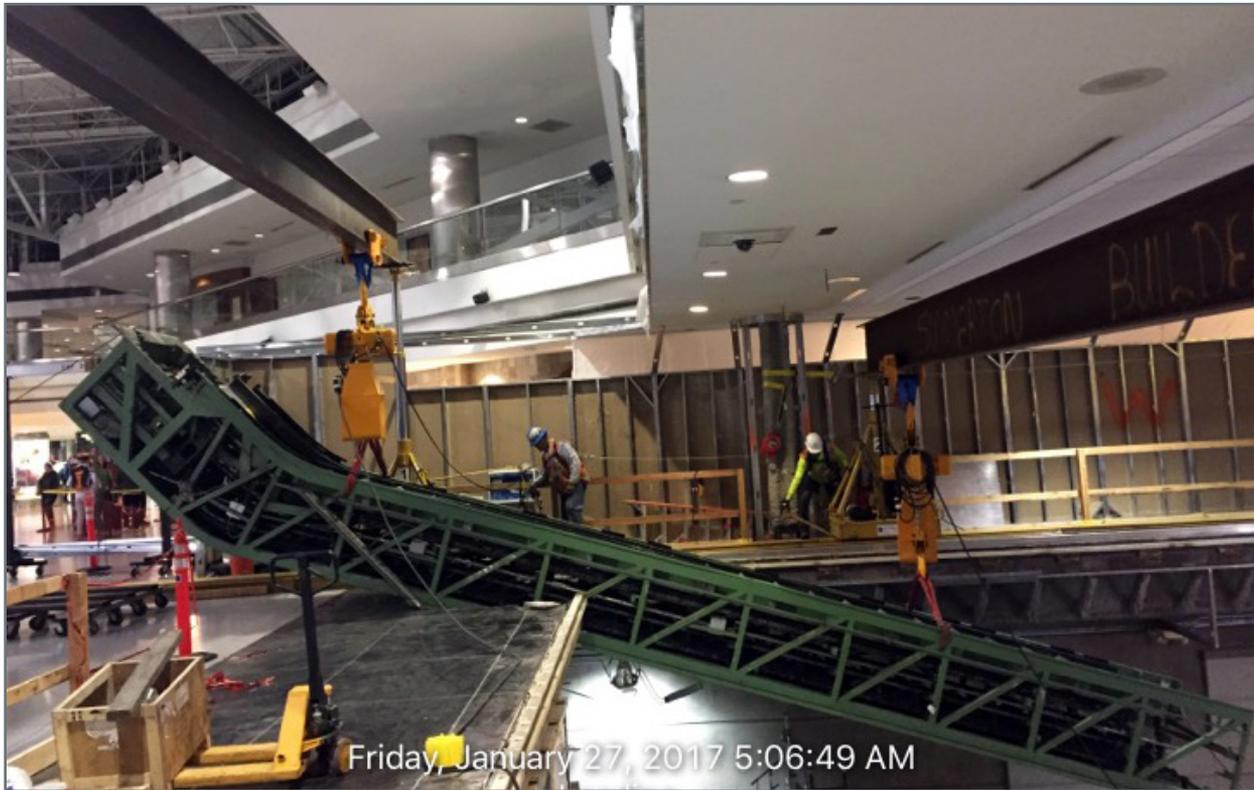


Top Photo: Swinerton coordinated usage of a gate on Concourse C to move the escalators in and out of the building
Bottom Photo: Delivery trucks and cranes carefully operated around airside roadways and parked planes



Top Photo: The space ready for a new escalator

Bottom Photo: New escalator being hoisted into the building through a gate on Concourse C



Friday, January 27, 2017 5:06:49 AM



Friday, January 27, 2017 6:39:45 AM

Top Photo: Workers install a new 18-ton escalator with a gantry crane
Bottom Photo: Swinerton's site all closed up and ready for the next day of business at DEN