BURNS McDONNELL

CASE STUDY

Delta Air Lines Terminal Renovation Looks Ahead to Traffic Future

Addressing traffic and roadway infrastructure challenges to support the Delta Air Lines terminal at LaGuardia Airport began with a clear understanding of how to meet passengers' travel needs, especially during peak hours, without sacrificing speed or service.

Challenge

While maintaining full operations, LaGuardia Airport underwent a $3.9 billion project to construct a new Delta Air Lines terminal. To support ground traffic to and from the terminal, additional roadways and bridges were needed. Ever-changing technology, rising passenger expectations and increased traveler volumes created the need for a more seamless roadway experience.

The roadway and bridge network for Delta Air Lines at LaGuardia Airport needed reconstructing to address aging infrastructure, congestion and traffic access issues. Site constraints created a major design challenge because the airport is bound on the north by Flushing Bay and on the south by Grand Central Parkway. These challenges necessitated significant road enhancements, required the design of new traffic controls and involved an updated intelligent transportation system (ITS) that would support the new terminal's roadway operations.

Project Stats

Client
Delta Air Lines

Location
Queens, New York

3,200
LINEAR FEET

6
MONTHS OF TIME SAVED

$200M
TOTAL ROAD & BRIDGE COSTS

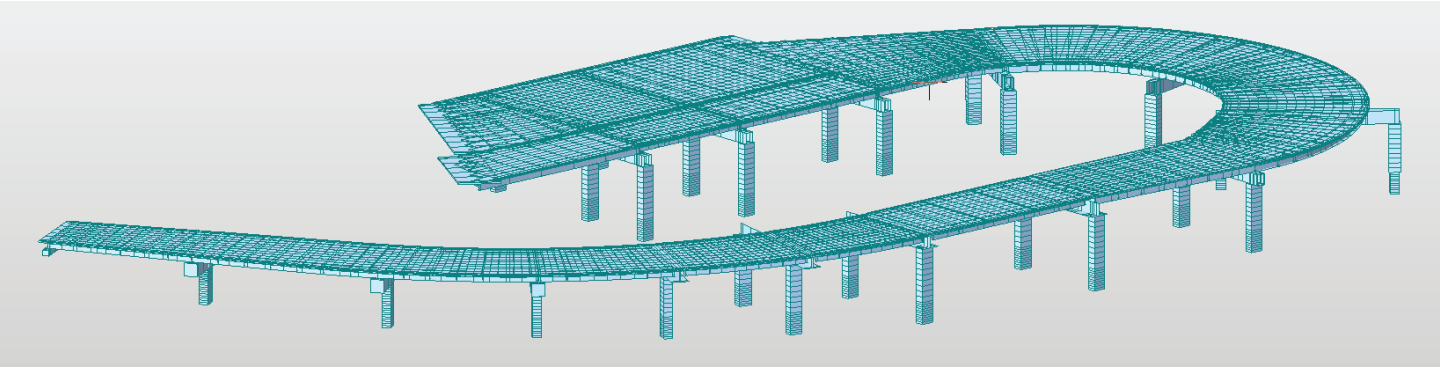

Figure 1: Horseshoe-like design is one of the many solutions used to address project challenges.

Delta Air Lines is LaGuardia's largest carrier. Given Delta's high passenger traffic, it's important for both the airport and the airline to support safe, accessible and convenient ground transportation.

Solution

Burns & McDonnell designed a new road and bridge system. While developing a permanent transportation solution that would improve ground traffic operations, the firm's design professionals also devised an extensive temporary transportation plan to minimize construction's impact on travelers, allowing for uninterrupted ground transportation service.

Every decision the project team made focused on minimizing the project's effect on customers, employees and the surrounding community. Meetings with multiple interested parties were conducted early in the process and included Delta Air Lines, the Port Authority of New York and New Jersey and the LaGuardia Airport master planning team. Following these meetings, regular coordination meetings with the Port Authority and other teams were conducted throughout the project's development to coordinate airport, airline, and road and bridge activities.

Managing Peak-Hour Traffic Service Levels

Partnering with Delta Air Lines and working closely with the Port Authority, the project team evaluated interim phasing and designed landside roadway solutions to optimize traffic operations. In order to accommodate forecasted traffic demands, the team designed a future-proof arrival and departure curb frontage and road system. The new design separates private vehicles picking up passengers onto a different road from taxis and other for-hire vehicles, easing congestion and enhancing the passenger experience.

As part of the strategic design process, the project team developed innovative phasing proposals. Addressing traffic concerns began with understanding how to serve travelers on traffic-heavy days during peak hours without sacrificing speed, service or quality. The team sought to keep travelers moving on time and in a manageable fashion despite construction.

The multiple traffic tasks began with the collection of Delta Air Lines terminal traffic data and some off-site traffic data. This information was used in the development of proposed roadway solutions during each stage of the project. The effort required the ongoing evaluation of existing traffic conditions, development of seasonal adjustment factors, traffic projections for future years based on flight schedules, and the redistribution of traffic onto the proposed roadway.

Bridging It All Together

Burns & McDonnell engineers designed an ITS to meet the new roadway network's guidance, safety and security needs. The project's ITS work included the design and installation of dynamic message sign boards over the road and at curbside in the arrivals pickup area. Also installed were traffic signal systems, closed-circuit TV cameras, magnetometer vehicle detection sensors and a road weather information system.

When considering the design for the new road that serves both arrivals and departures, environmental requirements dictated that the system couldn't extend out over Flushing Bay and had to double back in front of the terminal. That led to tight road curvatures and a challenging road design. Designing the complex geometry of the project, providing continuous traffic access to the old terminal until the new one was completed, and extending no road above the waterway were all significant project challenges.

While the new terminal was being constructed, the design team created a temporary bridge system to help traffic continue traveling to the existing Delta Air Lines terminal. There were five different temporary bridges consisting of a total of 10 spans plus one Acrow bridge. After this temporary

system was established, the project team focused all attention on a permanent road and bridge system at the new terminal that included adding several departure lanes. In an effort to determine how best to build out the area, the team developed a 3D physical model using OpenBridge software to visualize each construction phase. Midas Civil software was then used for the 3D structural analysis and design to determine capacities needed to support traffic loads under normal circumstances and in case of extreme weather or seismic events.

To satisfy the site constraints, construction phasing and new terminal location; the team developed a complex alignment for a 3,200-linear-foot elevated departures roadway that included a tight radius horseshoe configuration. The permanent bridge structure included 84 columns and 39 spans. Supporting beams on top of the pier caps are 800 disc bearings and another 74 seismic isolation bearings. The work required 54,000 tons of concrete and 14,000 tons of steel.

Managing Seismic Events and Settling

Another important factor for the design team to consider was that the airport was nearly 100 years old and had experienced varying degrees of settling. For any new loads introduced onto the site, the settling factor had to be taken into account.

The solution was to include potential differential settlements as additional load cases in the bridge design — meaning if one support settles slightly relative to another, the bridge can manage it with no problem. Also, to accommodate potential seismic events, (i.e. earthquakes), the team used a displacement-based design approach instead of the more traditional force-based approach. To help reduce column sizes due to seismic forces, the team used seismic isolation bearings so that the superstructure can react independently from the substructure. This way, during an earthquake, the bridge deck will "float" on the seismic bearings and not transfer all the load directly into the bridge columns. This bend-don't-break approach allows for inherent flexibility in the structure.

Results

The construction of the new Delta Air Lines terminal at LaGuardia Airport presented many complex traffic operations challenges, beginning with an aggressive timeline and numerous space constraints. Through the efforts of the Burns & McDonnell team, in close collaboration with multiple partners, traffic congestion at the new terminal has been eased, essential airport operations were maintained during construction, and a positive traveler experience is being preserved.

The project was completed on budget and six months early.

About Burns & McDonnell

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