Terminal Power

An entire terminal at Boston's Logan International Airport is being replaced—with major power system enhancements—all the while keeping construction landside and air service flying

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As New England's largest transportation center, Boston's Logan International Airport keeps five terminals busy. But in August 2001, Delta Air Lines reached an agreement with the Massachusetts Port Authority (MPA) to develop a replacement terminal, for the original Terminal A, to be owned and operated by MPA.

Reduced capacity needs—a result of the events of 9/11—made it possible to close the terminal and relocate the carriers to other terminals at Logan. This, in turn, made possible a landside construction project. Several phasing plans were developed to keep 10 gates operational during the construction, and this $400 million project is scheduled for a March 2005 opening.

Substantial revamping of primary and emergency power systems were part of the project and offer a look at power strategies at a major international airport.

PRELIMIMARY INVESTIGATIONS

TMP was hired to study the underground high-voltage (15-kV) and low-voltage (LV) utilities at the 100 acre site in 2000. There were existing HV ductbanks and LV ductbanks on the site that had to be relocated.

Ways were found to maintain some of the larger ductbanks in place by routing them under the buildings. One HV ductbank had eight active 15-kV feeders, and one LV telephone duct-

What's Driving Electrical Specs?

With the release of the new 2004 MasterFormat by the Construction Specifications Institute, those who use MasterFormat will find themselves organizing specs a bit differently these days. For example, at Logan International Airport, Boston, on the project to replace Terminal A, variable-speed drives were purchased under CSI Division 15000. VSDs, however, were specified under Division 16000, owing to the fact that the manufacturer of these 18-pulse drives was also the maker of the switchgear. Including these items under the same division provided better pricing and better consistency for MPA. All VSDs were specified with manual bypass, and units 75-hp and larger were specified with reduced voltage bypass starters. Another feature was that the enclosures were specified as NEMA 12, gasketed and filtered to protect against dirt.

bank contained more than 7,000 total pairs of copper cables. These would have been very expensive to relocate.

Load data for MPA's three existing utility substations made it obvious that a new fourth utility substation would be necessary to serve the new terminal and maintain the reliability and redundancy that already existed in the HV system. Site logistics made it possible to locate this substation in the new satellite building and still meet all of the security issues involved while still providing the utility company with landside access.

The terminal and satellite buildings together are approximately 650,000 sq. ft., with a connecting passenger tunnel of approximately 800 ft. that passes under the taxiway area. The satellite building was built over the new Ted Williams Tunnel. To simplify security, the project is being built as a landside project, rather than on the airside. A 1,700-ft.-long temporary blast wall was constructed to separate the project site from the airline operations area.

Chilled- and high-temperature hot water from Massport's central plant are run through the existing landside tunnel network, which was extended to the new terminal. New access roadways at the arrivals and departures levels, and new overhead passenger bridges, are brought into the terminal building, where all passengers are ticketed. But it's really the power distribution story that we are interested in here.

PRIMARY POWER

Logan's main substations serve the terminals and various other buildings at the airport via an underground network of manholes and ductbanks. Terminal A increases the number of incoming utility services from six to eight, and the number of main substations from three to four. All four substations are connected via intertie feeders that enable MPA to maintain power if any one station is down. As part of the Terminal A project, modifications were made at the other three existing utility substations to improve reliability.

Incoming line cubicles must meet the utility company's stringent specifications for primary metering switchgear. Utility and MPA feeder breakers are vacuum breaker technology with sophisticated solid-state protective relays and metering. Utility company revenue metering is totalized between the four substations. Power factor correction is applied at all primary substations to avoid penalties from the utility company when the power factor is below 90%.

Correction is done on the primary side at 13.8 kV. Feeders in the Terminal A substation serve four double-ended substations, two in the terminal and two in the satellite. Other feeders provide backup for major loads on Logan's system. The double-ended substations in A are comprised of dual primary switches, cast-coil transformers and 600-volt switchgear with power air breakers for mains, ties and feeder breakers with automatic PLC transfer upon loss of one line or one transformer.

Massport can legally sell power to its tenants. All airlines and retail tenants are separately metered. Airline back-of-house areas, and each of the 22 boarding gates with their individual pre-conditioned air, 400-Hz ground power unit and battery charger for GSE equipment, are separately metered by solid state meters with ANSI rated CTs.

When it came to power monitoring and control, MPA centrally monitors all switchboards, substations and variable-speed drives throughout the airport. Devices are run to local nodes with copper cables. The nodes are connected around the site by fiber-optic cable. Graphic displays afford a user friendly way to view each power distribution point. Breaker control is also available if necessary to open a circuit in an emergency. Under the Terminal A project, new computer nodes were added and tied into the central system over fiber-optic cable. Also, all other existing computer nodes, plus software and graphics were upgraded airportwide.

EMERGENCY POWER

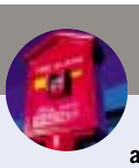
The logistics of the site required that there be two standby diesel generators, one for each building, the terminal and the satellite. Each generator has a prime rating of 910 kW, 1,137 kVA at 480/277 volts. These are special low-emissions units housed outdoors in aluminum, sound-attenuated, walk-in enclosures. The generators provide backup power to the elevators, smoke evacuation fans and emergency lighting. Emergency power is provided for the boarding bridges to permit operation in event of a power outage.

Some of the luminaires in the underground passenger tunnel that connects the terminal building to the satellite building, even though wired to the generator, also have emergency battery ballasts to prevent panic during the 10 seconds or less that it takes for the generators to start and come online after a power outage.

With respect to luminaires and lighting controls in general, interior and exterior luminaires are wired to smart breaker panels and controlled by automatic time of day switches and local manual switches. Concourse spaces utilize daylight harvesting with dimming ballasts and photocells. Energy consumption is a primary concern and the buildings have an overall connected load of 1.3 watts per sq. ft.

Airside lighting is provided by 1,000-watt metal-halide luminaires on 80-ft. high-mast steel poles with lowering devices. Landside roadway lighting uses 250-watt metal-halide luminaires on 35-ft. steel poles.

Eventually, the final result will be a new terminal that guarantees power continuity in normal times and in the event of an emergency. ENDD



An Alarming System

Current fire-alarm technology and design dictates analog-addressable systems for accurate reporting for firefighting personnel. In the terminal replacement project at Boston's Logan International, each building has a stand-alone fire command center and several remote annunciators integrated with a microphone for firefighter's emergency announcements in large open areas. Each building has general evacuation during a fire condition.

The public address system is utilized for primary fire reporting in public areas. When an alarm occurs, the fire-alarm system seizes control of the PA system to allow instant reporting and superior intelligibility during a fire event. If there is any problem with the PA system, the backup fire-alarm speakers will transmit the alarm. All building alarm, trouble and supervisory signals are transmitted from the respective building FCC over fiber-optic cable to the central reporting station in Massport's Facilities I Building.