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WHAT'S UNDERGROUND

Atlanta's latest runway project is said to be one of the most complex structures of its kind.

FAA, Atlanta International share lessons learned with latest runway project

A new 9,000-foot runway at the Hartsfield-Jackson Atlanta International Airport in Atlanta was officially commissioned in May. This runway, said to be one of the most complex structures of its kind in the world, spans a major interstate highway and includes an 18.5 million cubic yard embankment. Here, FAA and airport officials share some insights learned along the way when it comes to putting in underground systems that can be easily traced.

Hartsfield-Jackson Atlanta is the world's busiest passenger airport, serving more than 89 million passengers in 2005 alone. Delays at Hartsfield-Jackson can create a ripple effect across the continent and hamper airport efficiency all across the nation. Consequently, the new runway has been called the most important runway in North America.

The Southeast Region office of the Federal Aviation Administration (FAA) is responsible for installing and maintaining flight-related airport facilities for this expansion, including navigational aids, instrument landing and approach lighting systems, and the buried cables required for these functions. As new cables were buried adjacent to the new runway, approximately 1,000 discrete locations were electronically marked as a safety measure and to facilitate future maintenance.

According to FAA Project Engineer Brian Murphy, the traditional means of identifying the location of buried airport facilities has been to place 2'x2'x6" concrete markers flush with the ground, immediately above marked features. These heavy markers cost about $100 each, and require painting as well as ongoing attention to remove grass clippings and repair soil erosion. They can be easily displaced by mowing equipment, which can compromise facility records and excavation accuracy.

The traditional means of tracing buried airport facilities involves the use of locating equipment which senses an electromagnetic field created when an applied signal current flows through the buried conductive elements to a distant ground point. Murphy notes that this process is effective for tracing isolated metallic cables, but delivers ambiguous results where there is underground congestion — the technology cannot positively identify multiple adjacent buried facilities.

"We determined that a better method was required for marking and locating underground cable routes, and eventually we adopted buried markers because they are safe from surface threats, require no maintenance, and provide very precise locating," said Murphy.

"We initially used passive markers, which indicate location only, but have settled on active identification markers that can be programmed with specific information about the location when they are placed, and then read later from the surface using an electronic locating device. Unlike traditional locating, buried markers allow the locator to easily distinguish between adjacent facilities and make it possible for crews to excavate safely even under crowded underground conditions."

UNDERGROUND GUIDELINES

Underground utility markers conform to a national utility color code and interrogation frequency standards for each utility type so that excavators can identify both the location and the nature of buried facilities. FAA is placing red markers for facility power cables and black/orange markers for fiber optic and other communication cables at the Atlanta location.

FAA engineers selected the 3M™ Dynatel™ 2200MiD Series Locating and Marking System for the Atlanta airport project. This marking system uses 4-inch round ball markers, each of which has a unique, preset, and remotely readable ID number. An electronic circuit in the ball is programmed with custom information, which can then be located and read remotely. Murphy explains that FAA has developed a series of scripts for ball marker programming that includes details such as the nature of the buried facility (cable type, number of conductors or fibers, etc.) and the exact depth below grade. FAA has established 30 such identifying scripts, covering every combination of details for their buried facilities at the airport. Program and

placement details for each marker are archived in the locator device as they are programmed, and these records are downloaded electronically at the end of a shift for archiving.

"An above ground locator can pinpoint the position and depth of an electronic marker so precisely that it is possible to dig down and find the ball with a posthole digger," says Murphy. "Traditional locating equipment relies on an electrical return signal from a conductive element such as a pipe or cable and can provide only an approximation of location. Ball markers will help protect critical buried FAA infrastructure, and make it very easy to pinpoint and excavate a buried segment or discrete point in the future."

According to the FAA project engineer, marker placement at the Atlanta site has been done by a resident FAA engineer working in conjunction with cable placement crews. The engineer scripts each ball using the portable locating device and places it in the cable trench as work proceeds. Murphy's staff is currently developing a specification for this process. Future scripting and placement work will be done by contractors in accordance with this document under the supervision of FAA field inspectors.

"Construction work around active runways is done at night to minimize flight disruption," Murphy explains. "We position the markers at 200-foot intervals for long cable runs and at turn points, at intervals around curves, and ten feet apart in congested areas and around manholes. Both sides of every buried utility road crossing are also marked. As each marker is placed, its identifying label is removed and placed on a field map. These marker radio frequency identification (RFID) numbers will eventually be transferred to as-built drawings for site mapping and for reference by construction crews and field engineers.

"There may be a need in the future to extend airport taxiways, add turnoffs, or replace equipment, and this work will benefit from the precise underground records and locating capabilities we have established during construction," he says. "However, our principal motivation for this marking and locating investment is to avoid construction-related wire and cable cuts, which are extremely costly and present unacceptable safety risks and airport delays."

Construction workers at Atlanta International use a vacuum excavator to dig holes directly above cable entrance and exit points at a manhole location adjacent to the new runway.

HIGH VOLTAGE CABLES

Another project currently underway at Atlanta's Hartfield-Jackson International is placement of new underground high voltage power cables on the airport's south side. Bob Blanchette, FAA project engineer responsible for the project, notes that cable replacement is being done to upgrade the old power distribution network that serves dispersed navigational aids. Existing cables are 30 to 40 years old and suffer from splice failures, maintenance problems, and vulnerability to power surges and lightning damage.

"There will be about 30,000 feet of new cable installed in this effort, as well as new switch gear and transformers to support navigational aids, including instrument landing systems, precision approach path indicator, and runway visual range systems," says Blanchette. "Cable runs are point-to-point and laid in straight lines wherever possible, with RFID markers placed at either side of each intermediate manhole, on each side of every system facility, and every 200 feet along straight cable runs."

FAA has informed the Airport Department of Aviation of this construction and marking project, and will share information on infrastructure marking with airport crews and authorized contractors for mutual benefit.

The marker locator used for this work and for the runway addition has a GPS feature that allows for automatically collecting GPS coordinates for markers as they are buried. GPS information can be placed in the mapping database along with marker locations and other infrastructure details. GIS mapping will eventually show all underground facilities, including global coordinates for each marked location, and help ensure that future excavation, maintenance, and construction work will not compromise worker safety or the integrity of airport facilities.

Unlike surface markers, such as stakes, flags, or paint, a buried RFID marker is not affected by overgrown vegetation or maintenance equipment and can't be worn away by weather. Markers act as passive antennas, reflecting back the query signal from the locator without need for an internal power source. They are impervious to moisture, minerals, chemicals, and temperature extremes. Internal components are self-leveling, ensuring that they will always be in a horizontal orientation for best signal strength regardless of how the device is placed in the ground.

One Atlanta airport challenge that will be relieved by the use of identification markers and mapping is the problem of unmarked and abandoned cables, Brian Murphy explains. For example, in the past, a fire rescue building located on the north side of the airport was served by a number of undocumented cables buried at shallow depths. The presence of cables such as these slows construction process as crews must take precaution to confirm that lines encountered during cable placement are not in service. Properly marked and mapped facilities will prevent this problem in the future.

"Fiber optic cable replacement efforts are planned or underway at many of the major commercial airports in the FAA's southern region," says Murphy, "and we have adopted RFID markers for all new buried infrastructure work."

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