Top Flange Trench Drain Assemblies
Memphis International Airport
Apron Replacement Project

Case Study
MEM Apron Renovation
Includes Essential Drainage System

Situation
Starting in 2012, the Memphis International Airport (MEM) began work on improving the hub to align itself with the changing needs of the port and improve service to its passengers. To help this project, the Federal Aviation Administration (FAA) awarded the Memphis International Airport a $31.8 million grant for runway safety, pavement and security projects.

According to the Memphis-Shelby County Airport Authority (MSCAA), the governing body that directs the future of Memphis aviation, the terminal modernization project is expected to total approximately $114 million in capital costs. The project is expected to be completed by 2020.

Consolidating and Adjusting Services
The project includes the demolition and removal of the entire south ends of both the A and C concourses to allow for unobstructed access to gates of the updated B Concourse by larger aircraft such as the Airbus A380.
Plans include consolidating the airline and food, beverage or retail concessions into the B Concourse; and making improvements such as additional moving walkways, wider corridors and larger boarding areas. The remodel will also account for changes in carrier needs and positions at the airport.

**Updating Structure and Improving Safety**
Many of the existing aprons were originally built during the 1960s and ’70s. Presently, outside of B Concourse - and a significant feature of the apron reconstruction - the trench drainage components are part of a system intended not only for stormwater management, but also functioning to contain or manage fuel spills.

The airport consulting engineers configured a series of concrete firestops into each run of trench with the sluice gates that can be remotely activated and closed to prevent fuel from flowing into storm drains in the event of a spill.

The airport’s stormwater drainage is a gravity flow system with no pumping stations that flows into Nonconnah Creek, which makes its way to the Mississippi River.

**Precipitation Expectations**
The greater Memphis metropolitan area receives an average of 50-60 inches of precipitation per year, according to the National Weather Service. Historically, the airport expects the heaviest annual 3-hour rain event to produce 2” and 3.3” in 24-hours. But, predictions also include a 100-year event of 4.5” in 3-hours and 8” in 24-hours. (MSCAA SWPPP references NOAA Atlas 14 Point Precipitation Frequency Estimates.) These precipitation values need to be considered when providing a solution to adequately handle the drainage needs for MEM.

**Solution**
The linear trench drain assemblies from EJ feature a top-flange design, to enhance the load bearing capabilities of the trench system. The design provides a better interface with the concrete structure by the flange protecting the structure’s edges, which
helps prevent structural failure beneath the trench frame (see Figure 1 and 2).

“We designed the drainage system, including the trench drain system, and specified aircraft rated frame and grates to be installed,” said Patrick Neal, Principal/Transportation Project Manager at Pickering, Inc. “The contractor selected a product according to the specifications and we reviewed the submittals for compliance.”

The trench grate assemblies are load rated as Airport Extra Heavy Duty. This load rating uses a testing method outlined in the AASHTO (American Association of State Highway Transportation Officials) specification M306. For airport rated product, EJ modifies the test by applying a much higher load of 200,000 pounds.

Other attributes of the trench grate assemblies include vertical gussets with openings positioned to allow for rebar to be run through the top flange frame and tie the unit into the reinforcing steel. These holes are also designed for bolting adjacent trench grate products together (see Figure 3).

Three other desirable features have also been incorporated into the EJ trench product:
1. Allow for continuous slight elevation changes during construction of the trench system. Since the drainage grate assemblies are placed in two foot increments, their position can be continually re-aligned during installation – allowing the trench system to follow the designed contours of the apron area. Alternative pre-formed trench components weren’t capable of easy elevation changes during construction.
2. All 6900 series frames utilize the EON LOCK® feature for insertion of a replaceable threaded nut. Holding the replaceable nut in position once unbolted, the EON LOCK reduces the possibility of the nut falling down into the structure or being lost (see Figure 4).
3. Include vent slots in the top of each trench frame. During construction, the vent slot allows air to escape while concrete is being poured, and provides a visual check for inspectors to verify whether concrete has flowed completely under the trench frame (see Figure 5).

Figure 1
With a wide 5 1/2” flange, fully supported with concrete underneath, heavy loads can be distributed over a larger area which reduces cracking and spalling of the surrounding concrete.

Figure 2
The grate rests on a concrete supported ledge for the rail. Force from the grate is directed down the ledge of the rail and into the concrete foundation.

Figure 3
Gussets incorporate holes for using rebar reinforcements and to bolt rails together.

Figure 4
EON LOCK® retains the nut when the grate is unbolted and allows the nut to be removed in the future should it need to be removed or replaced.

Figure 5
Venting slots in the frame rail allow for air to escape during the pouring process, fully filling the voids with concrete for support and weight disbursement.

Figure 6
Hinged hatch access covers provide safe ease of maintenance by using a mechanical strut to reduce the lifting weight (under 35 lbs.), yellow safety catch bar to prevent unintended closing of the cover, and can be secured with up to four bolts.
EJ was also the source for a quantity of airport-rated hatch assemblies designed to provide operations personnel access to the sluice gates. The 30” x 30” hinged hatches are located between sections of trench drain and corresponding storm drain inlets. They are frequently used in other applications when fire hydrants are placed below grade (see figure 6 on page 4).

EJ also provided a number of other infrastructure access solutions for the Memphis Airport B Concourse apron reconstruction project, including:
· 1895 and 1900 series manhole access assemblies
· 8555 model 5 1/4” water slip type valve boxes with 6800 series pent head locking covers and extension risers
· V5668 model 44 1/4” wide 5” deep top-flange frame bolted 2-grate catch basin assemblies with anchor studs

Result
The apron work involved replacing the aging concrete pavement on all sides of the airport’s B Concourse – and also requires installing significant amounts of upgraded infrastructure. 320,000 square yards of concrete is being demolished and replaced around the perimeter of the concourse. Much of the new infrastructure includes a stormwater management system with trench drainage components manufactured by EJ.

Once the massive amount of concrete material was removed, contractors began building a (two feet wide by four feet deep) reinforced concrete trench structure. On top of the trench, top flange trench grate bolted (6908) assemblies were positioned in line to be poured integrally with the structure. The trench system was poured-in-place about 10 linear feet at a time.

In total, EJ is supplying about 10,000 feet of linear trench drain assemblies for the multi-phase, multi-year construction project.

On-site construction project management of the stormwater drainage system is being overseen by APAC-Tennessee, with installation performed by local sub-contractor GCM, Inc. Design engineering for this aspect of the job was handled by Memphis-based Pickering.

While wrapping up Phase 2 of apron reconstruction, managers at APAC-Tennessee recently commented on their experience with EJ products throughout the project. And, as Phase 3 was about to begin, APAC placed an additional order with EJ to supply material for installation of the remaining 2,000 feet of trench drain.

“EJ has provided quality products for this project, and was very helpful and responsive to any requests that we have had.”
- Walter Pearson, Project Manager, APAC-Tennessee

Using long threaded rods and beams, the assembled frames and grates are leveled to grade in the foundation before concrete is poured for the trench walls.

Reinforced with rebar through the frame rail gussets and in the trench wall greatly adds to the load capacity to withstand extra heavy duty airport traffic.

A section of completed trench walls with embeded fram rails merges into the framing of walls being prepared for concrete.
Once the trench drains are completed, the remaining apron is ready for concrete to be poured.

APAC’s Mike Morganthaler said EJ was a valuable resource by suggesting the 8196 model hatch assemblies as an access solution for the sluice gates. The APAC team described the hatches as ideal, due in part to their having the same design load rating as the trench grates (Airport Extra Heavy Duty), and similar flush mount profile (both having top flange frames). These access hatch assemblies have a five-inch deep top-flange frame, and the covers are bolted along with cam-locking capability – featuring an innovative stainless steel mechanical spring strut for lift assist (only requires 35 pounds of lift force to open). The ductile iron castings feature a slip-resistant surface as well as the MPIC® multi-tool pickbar option.

“An example of the customer service and support by EJ resulted from our realization that one of the specified end-piece frame components turned out to be unneeded in our case,” said APAC-Tennessee project manager Mike Morganthaler. “As our contractor began installation of the trench grates and observed some potential concrete forming issues – EJ worked with us to delete the end frames from shipment quantities, and was a resource providing guidance or troubleshooting when needed to help us adjust our method of installing each drainage assembly.”

Nearly 10,000 linear feet of trench drainage is being reconstructed using EJ products.
The completed sections of apron of B Concourse.