Construction of Dey Street Concourse Structural Box Presents Many Unique Challenges

Published in Design-Build Dateline magazine; September 2007; Featured Stories

(Design-Build Dateline is the official publication for the DBIA (Design-Build Institute of America), which is a nationwide industry association of great importance in construction.)

By Karen Diemer and Sean Glynn

The Skanska-led team began work on the design and construction of the structural box under Dey Street near the former World Trade Center (WTC) in Manhattan for the new Fulton Street Transit Center in July 2005. The scope of work includes construction of the underpasses at the R/W and 4/5 subway lines to connect the Fulton Street Transit Center with the permanent PATH (Port Authority Trans-Hudson) terminal.

The PATH terminal is being constructed by Phoenix Constructors, a joint-venture that also includes Skanska along with Fluor Inc., Bovis Lend Lease, and Granite Construction. The Dey Street Concourse will begin at the WTC site where it will cross under active subway lines and continue east until it terminates on the east side of Broadway. It is estimated that about 275,000 people will pass through here each day.

During the first six months of construction the R/W station was closed to passengers, but trains continued to pass through the station. The Cortlandt Street station, which was initially closed for construction of the Dey Street project, remains closed to accommodate activities at the WTC site. All of the adjacent subway lines will be in operation during the entire construction period with the exception of weekend outages.

The project covers an area 400 feet-long, 30 feet-wide, and depths of up to 45 feet underground. The contract requires installation of over 1,100 tons of structural steel, 900 tons of rebar, 12,000 yards of concrete, as well as construction of 32,000 square feet of temporary decking.

The project can be divided into four general work segments: the R/W subway line underpass, which begins along Church Street; the Dey Street Concourse structure; the Dey Street entrance pavilion that is being constructed to provide a new street entrance to the concourse and the 4/5 subway station platforms; and finally, the 4/5 subway line underpass. The project requires cut-and-cover tunnel construction as well as extensive underpinning to protect active subway lines and stations that are above the work areas and excavation for the new stairs to connect the platform.

Major work activities include excavation, identification and relocation of existing utilities, earth retaining structures, underpinning of adjacent building structures, track work, and heavy structural steel and concrete work. All of this will be taking place in the extremely congested area of lower Manhattan and right underneath active New York City Transit subway lines as well as busy streets.

The project will require over 40,000 cubic yards of earth excavation. Mini-piles will be used for underpinning of the existing trackways and platforms while secant piles will be used for underpinning of nearby buildings and as a water cutoff and decking support system.

Under the existing subways, jet grouting was used for water cutoff because secant piles could not be used in certain areas since there were active utilities there and the fact that an operating subway line could not withstand drilling. Ejector wells were then used to remove water from the construction area.

To allow construction of the concourse at Dey Street to proceed under difficult subsurface conditions Skanska's chief engineer on the project, Vince Tirolo, designed a support of excavation system to include jet grouting to create a subsurface temporary cut-off wall to protect the tunnel from water seepage.

Because of the short time frame for track shutdowns and the limited headroom available for jet grouting the team used low-headroom equipment to perform the work.

As with the jet grouting, construction of the mini-piles required low-headroom equipment to install piles up to 100 feet long in 2.5-foot increments on weekends. The mini-piles will hold up the existing subway while the new box is being constructed underneath.

Another challenge was the requirement to use ultra-low sulfur diesel fuel and diesel particulate filters on all equipment graded at 50 horsepower or above. By the time this project is complete, this will be required on all projects in New York City in accordance with a newly enacted law.

The Dey Street structural box will be a part of the future Fulton Street Transit Center, which will eventually connect to the permanent PATH terminal at the WTC site.

Skanska is working closely with DMJM Harris, who is providing design services for the box and concourse platform and roof elements. Not only is the project extremely challenging for the engineers, but other issues such as site security and public safety also figure heavily into working in lower Manhattan.

Transitioning from the bid and proposal phase to beginning the design of the project worked out well since so many people that worked on the proposal were also assigned to the project team, as was the case with Sean Glynn, Senior Estimator and on-site Design Coordinator. The fact that the relationships were pre-existing and the team members all knew each other has certainly contributed to the success of the job.

“Working with DMJM is great because their office is in lower Manhattan. We have daily meetings to review documents for constructability and cost savings,” Glynn said. “Questions and problems that could take days to resolve under normal circumstances now take hours.”

The close proximity of DMJM also expedites Requests for Information (RFI) and contributes to an overall feeling of teamwork rather than one of adversaries. When there are particular items of concern, those issues are addressed with design status meetings at which Skanska and DMJM both participate. “The constant face-to-face between all the team members has really allowed design to progress smoothly,” Glynn said.

This has been no easy task as the client’s engineer (Arup) has made necessary changes to the design of the complete Fulton Street Transit Center. These modifications have resulted in change orders. “The design work on this project has been keeping pace with changes made by the client’s engineer and this is due in large part to our good working relationship with DMJM and the MTA,” Glynn said.

Some of those significant change orders have been initiated to address security concerns for the future Fulton Street Transit Center. For example, the client requested blast protection for the column supports for the subway overhead, which included steel plates to encapsulate the columns in all public access areas.

“Working in lower Manhattan presents many challenges,” said Glynn. “Public safety and site security are some of the issues we face in a post-9/11 New York,” he continued. The new security concerns meant that every team member had to rethink their usual approach to security and think of new, creative ways to complete construction and achieve milestones in the midst of one of the nation’s most high-profile areas. For example, a system of photo identifications was required by the client. The IDs allow the project team to keep track of personnel, which is of particular importance during weekend work when the shifts are staffed with additional personnel who may not be familiar to the project team.

At one point, the entrance to the Cortlandt Street Station was open to allow access to the temporary WTC Path Station. A security guard was stationed at the entrance of the station to check IDs for site access

and to ensure that curious pedestrians did not wander into the station, which could be dangerous for those not safety-trained.

As work on the project moved to the lower level, many of those access sites have been completely closed for everyone but construction personnel. This serves the dual purpose of making sure that pedestrians do not get injured and that no one can do harm to the exposed transit system and tunnels. Throughout the site, Skanska has placed barricades on the street, which encompass the work area. The barricades are five feet tall. This height ensures that the project team can make periodic inspections of the vulnerable areas to make sure that no unauthorized personnel are in restricted areas.

”We provide 24-hour security on the project,” Glynn said. The security team helps with material deliveries for the project as well as for businesses and assists with any emergencies that take place. The on-site security personnel walk the project site regularly during non-working hours.

“At any project in Manhattan, material delivery is challenging because you are working with a very limited laydown area,” Glynn continued. “But Skanska has such a good working relationship with the Port Authority (of New York and New Jersey) we were able to use part of the WTC site as a staging area for heavy equipment and material delivery since work had not yet begun there.”

That access allowed the project team to get material delivered to the site much quicker than they would have if they had to find another place to take those deliveries. But being on the WTC site, even in a temporary capacity, had its challenges as well. Not only did the Port Authority require ID badges for any team member who would be on site, but they also required extensive background checks. Any drivers making deliveries had to get temporary day passes and the vehicles were thoroughly inspected.

”In order to maintain the integrity of the WTC site we installed additional barricades and gates to differentiate the two work sites from one another,” Glynn said. “This also kept unauthorized personnel from entering areas that they should not be in.”

Safety, of course, is also a great concern at the site and to address those issues the project team regularly holds evacuation drills. “This helps everyone at the site be prepared and trained to work with the Fire Department and New York City Police Department in the event that the worse happens and there is some sort of terrorist attack,” Glynn continued. “One of the most important things about working in New York City is simply being prepared.”

Skanska is also on the team that is building the new WTC PATH station. Although this is not a traditional design-build project, the design work is ongoing while the joint-venture of Phoenix Constructors performs construction activities. The designer is employed by the Port Authority. However, the Phoenix team is regularly called upon to provide analysis of design drawings and comment regarding constructability and budget issues.

With work in progress on every project at the WTC site there was no longer a way to logically accommodate the needs of the Dey Street project team. This is especially true considering that security on the site has become more intense with hundreds of contractors all over the site and keeping track of them can be a challenge. As with the Dey Street team, everyone on the Phoenix team was required to undergo an extensive background check and issued ID badges. However, the badges are work-area specific. This has been done to maintain safety of each project area and keep non-authorized personnel out of areas where they are not working.

To address the intense security requirements of the site, the Port Authority erected a security station on street level. This is the area where visitors and deliveries must first pass through. Since the security trailers are at street level, security personnel can watch the site from above and also monitor the security cameras that are placed all over the site.

Security personnel are not just in this area though, they also monitor all entrances and exits where the general public might come in contact with construction personnel. They are equipped with scanners that

show a photo of the person whose ID is being scanned to ensure that the person trying to enter is who they claim to be.

Security surrounding material delivery has also increased. Vehicles entering the areas are thoroughly inspected and the drivers must submit to a security check and hand over their licenses while at the site. But regular suppliers get permanent guest passes to expedite their deliveries.

Subcontractors are also required to undergo background checks and must be approved by the Port Authority before they are even awarded a contract. The background check may include the principals of the company, not just those that will be on-site.

Safety is also of great concern in lower Manhattan and it is imperative to the client that everyone on the project knows what to do in the event of an emergency, so the Phoenix project team also hold evacuation drills. The drills are designed to keep the channels of communication open between the Port Authority, the Phoenix Team, and every other contractor working on the site.

As work proceeds throughout the WTC site, barricades are being put in place to further separate each project from the other as security is only becoming more stringent. This is certainly a high-profile area for both projects, but security at the WTC site is over and above what takes place at normal work areas.

”Obviously, given the nature of where both projects are taking place we have to be acutely aware of security, safety and tourists that are coming to visit the WTC site,” Glynn said. “It will be a long time before the area looks whole again, but we’re proud to play such an instrumental role in rebuilding lower Manhattan.”

INFO: Skanska USA Civil Northeast (www.skanska.com/usa)