



## Greenwich Street / #1 Subway Line Box: An Innovative Operation



View of #1 Subway Line Box construction from Church Street.

The World Trade Center site is the location of the most complex single construction project in the United States. Individual parts of the project are in themselves challenging and unusual: Whether it's One World Trade Center's impressive height and concrete base or the PATH Transportation Hub's novel design, The Port Authority of New York and New Jersey is building structures on a scale that is both original and complex. Construction of the #1 Subway Line Box is likewise a delicate operation for which The Port Authority devised a revolutionary construction method and implemented a significant amount of safeguards to ensure that the project is completed on time, within budget, and with consideration for the community and site safety in mind.

The Port Authority and its contractors are building permanent bracing for the structural Box (the skeleton of what will become the subway tunnel and station upon construction's completion) that will enclose MTA NYC Transit's underground structure for the #1 Subway Line, bisecting the WTC site from south to north. This will form the foundation for the future extension of Greenwich Street, which will run through the site directly above the structural Box.

The standard approach for such a job would be to complete excavation first and then build the grid of concrete slabs and walls, which will serve to permanently underpin the #1 Subway Line Box. The Port Authority's "top down" method will involve the contractors building the concrete

slabs and walls at the top of the support structure for the Box and working their way down. Thus, the micro-piles – beams which currently support the structure – can remain in place, and the new slabs and walls will provide the structure with additional support, allowing the construction to progress. Each successive level of construction will be completed in this manner. This approach is beneficial because it incorporates the existing micro-piles into the permanent structure, resulting in cost savings over the standard method as well as an expedited project schedule.

A project of such scope requires intensive noise and dust monitoring to protect the surrounding community, and stringent safety protocols to ensure the well-being of site workers. Weight restrictions for the Box have been established, and anything that may weigh significantly on the top of the Box, such as machinery or temporary structures, has to undergo an approval process. All contractors are meeting the site-wide Environmental Performance Commitments by submitting documentation for diesel engine

retrofit technology and ultra low sulfur diesel for off-road equipment to reduce emissions. All mobile construction equipment is required to have smart back-up alarms in order to keep the noise levels in check. Contractors also adhere to the established dust control implementation plan to suppress and reduce fugitive dust from leaving the perimeter of the project area.

Furthermore, all contractors have full-time safety managers dedicated to ensuring the work is done safely, efficiently and effectively. The contractors follow the WTC Safety, Health and Environmental Program as well as their own site-specific safety plan. Whenever particular hazards at the site are identified, The Port Authority quickly develops mitigation plans. Regular meetings are held to examine any safety issues at the site.

Completing the permanent underpinning of the NYC Transit's #1 Subway Line Box efficiently and cost-effectively will ensure access to the Memorial Plaza from Greenwich Street, which sits above the Box, by September 11, 2011.

Underpinning of Greenwich Street.



## WTC Hub: A Sustainable Achievement in the Works



Rendering of WTC Hub.

**S**ustainable design is one of today's hottest architectural trends, quickly becoming the standard for the way infrastructure is designed and built. It is no surprise that the future World Trade Center Transportation Hub, a cutting-edge structure conceptualized by the design architect Santiago Calatrava, is a prime example of sustainable design as well as sustainable construction planning.

The WTC Transportation Hub was designed with meeting the goals of energy efficiency and compliance with local and national environmental design codes in mind. The framework for the Hub's design revolves around the six environmental quality categories that are outlined in the Sustainable Design Guidelines for WTC Redevelopment Projects (SDG). These include energy, water, site, material, urban and indoor environment issues.

The Port Authority made sure that the design incorporates extremely efficient energy performance and maximum lighting power density. Other energy features include high efficacy fans; occupancy sensors in utility areas and occupancy controls for thermal comfort and lighting; and various other mechanical features which will reduce energy consumption while operating at

top levels. The Hub's Transit Hall is designed to maximize natural daylight in order to cut down on electrical lighting.

Recycling is a big part of any sustainable system. Thus, the Hub's water system will utilize harvested rainwater to serve low-flow lavatory fixtures, cooling systems and other areas that don't require drinking-quality water. Construction materials such as steel, board and tile will contain a high amount of recycled content. Even some of the wood will be sustainably grown and harvested.

Other sustainable design features include indoor air quality protection, requiring low emitting paints and adhesives, and regular air quality testing that will continue even after the Hub becomes active. Light-colored materials will be used on the façade to reduce the "heat island effect," an urban condition where building materials retain heat, thereby raising the indoor temperature of a building.

The WTC Hub's sustainable construction methods will comply with Environmental Performance Commitments – which were developed, and committed to, by all of the key Lower Manhattan transportation projects – such as using ultra-low sulfur diesel for non-road vehicles and imposing a strict time limit on idling engines. Plans are being developed for each contractor to minimize on-site soil erosion and migration of dirt and dust from the site; address waste removal and recycling of material at the site; and prevent indoor air quality issues resulting from the construction process to ensure the well-being of workers and occupants.

Through these sustainable design and construction initiatives, The Port Authority is making sure that the WTC Hub, when completed, will not only be an achievement of progressive architectural thinking but an example of how Green practices are integrated into our built environment.

## In the Spotlight:

**Joe Schwed**  
General Manager  
WTC Safety Program

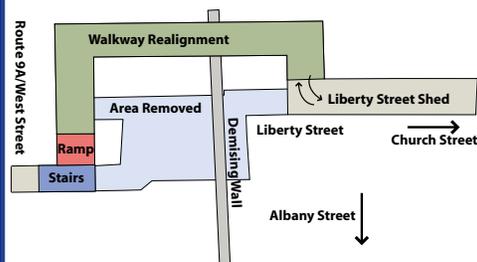


**Q: Do local community boards play a role in the development of site safety policies?**

A: Community boards play a critically important role. The input and feedback from community boards enables safety managers to know how community members perceive safety around the WTC site and which areas may require improvement. In turn, the Port Authority ensures that community members are updated on progress and safety initiatives through the Port Authority's Office of Program Logistics.

**Q: How does the Port Authority integrate technology into its safety operations?**

A: The Port Authority realizes the complexity of the WTC Redevelopment Program and constantly uses technology to help keep track of safety concerns. Computer programs track field safety observations, manage injury data and allow us to easily forward the information to contractors, who then take corrective actions on an expedited basis. Ultimately, technology plays a great role in the Port Authority's ability to track overall safety progress and enhance best practices.



Looking north toward WTC site.

slurry wall – a reinforced-concrete diaphragm wall stretching all around the site, below grade – with minimal pedestrian interruptions.

In order to proceed, The Port Authority had to coordinate with multiple entities, including NYS-DOT, NYCDOT, LMCCC, FDNY and DOB. The agency had to address local residents' concerns, and make sure that alternative pedestrian passageways were provided. This effort is an example of The Port Authority's sensitivity to the east/west pedestrian movements and the Agency's commitment to maintaining project schedules.

## Liberty Shed Relocation Pushes VSC Forward

**T**he Port Authority of New York and New Jersey has completed the relocation of the Liberty Street Pedestrian Shed, a crucial component of Vehicle Security Center (VSC) construction work that will help to ensure the project's successful, timely completion.

The Liberty Shed was reconfigured to permit continued installation of a demising wall along VSC's easternmost section while providing a critical east/west pedestrian corridor between the World Financial Center South and the Lower

Manhattan Business District. The shed reconfiguration allows The Port Authority to excavate the VSC site by early next year. The new walkway bypass begins at existing Gate 7, located approximately mid-way between the Greenwich and Liberty streets entrance and the Liberty Street Bridge stair. The reconfiguration allows pedestrians to proceed westward around what will become the demising wall, finally connecting with existing Liberty Street stairs. Moving the walkway to the west of Liberty Street allows for this demising wall to stretch to the existing

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