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Hot Tap Triumph


Novel water main relocation keeps faucets flowing and jets flying

Joe Fennell, Executive Director, Northwest Suburban Municipal Joint Action Water Agency, Elk Grove Village, Illinois, and **Robert Lewis**, Project Principal, Stanley Consultants, Inc., Chicago, Illinois

When O'Hare International Airport, one of the world's busiest airports, decided to take on a huge \$6.6 billion modernization project, many obstacles stood in the way.

The largest hurdle was the location of a proposed new runway. The enabling project for the desired route of expansion was the relocation of a nearly one-mile stretch of 90-inch pressurized water main that lay directly underneath the proposed path of the runway expansion. The main served 300,000 people living in seven nearby suburbs. Building the runway without moving the main wasn't an option, as any pipe maintenance would mean closing the runway to dig up the water main. However, interrupting the flow of water to relocate the main wasn't an option either, as any interruption in service would result in draconian water restrictions.

In came Tulsa-based firm T.D. Williamson and the firm's revolutionary hot tapping process. It allowed nearly 5,000 feet of the water main to be relocated without interrupting service.



Hot tapping, a rare but growing process, was unfamiliar to the Northwest Suburban Municipal Joint Action Water Agency (commonly known as NSMJAWA), owners of the water main. The organization required considerable reassurance of hot tapping's failsafe properties before allowing the project to proceed. However, since the next best alternative, rerouting the existing water line around the runway, would have produced the same results but cost \$80 million more, NSMJAWA selected hot tapping. Not only was the process more economical, it also resulted in a shorter design and construction schedule, no water service restrictions, minimal traffic disruptions, and the use of fewer natural resources.

Hot tapping required that two sections of the water line be tapped, a plug installed in each location, and the flow of water temporarily diverted to a bypass line while final connections to new lines were being completed. T. D. Williamson and Stanley Consultants, a Muscatine, Iowa-based engineering firm, worked together to make it happen.

Benchmark Construction uncovered 60 feet of the pressurized main so that two full sections of pipe were exposed. Ten large diameter concrete caissons and a massive concrete thrust block, designed by Stanley Consultants' Chicago office, were poured to cradle the pipe and to isolate forces created by T.D. Williamson's registered Stopple system. Then a 12-inch diameter test tap drilled out a "coupon" of the pipe that was studied to determine the requirements for the larger 60-inch tap. Using a hydraulic power pack, the 60-inch custom-made folding plug head inserted inside the main line.

The amount of pressure in the water line was a source of concern as it could potentially lead to joint failure in the unrestrained pipe. "I've never worked with a pressure that high in that big of a pipe," said Stanley Consultants' Project Manager Nathan Rick. "There was a design bulk head pressure of 1.6 million pounds on the thrust block. The most important requirement of the project was to have a zero deflection system. When the water flows through the Stopple the forces change from horizontal to vertical to horizontal again. We had to follow the force at each point of directional change and absorb the loads into our thrust restraining system."

The thrust block restraining collar absorbed the internal and external forces, transferring all loads from the hot tap and pipe into the ground by use of 10 large diameter caissons tied together with a concrete cradle and steel tube framing. Deeply anchored caissons were used due to poor soil conditions in the upper layers of soil.

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The coupon was studied to determine the needs for the larger 60-inch tap so that it would seat correctly.

water service.

"It is kind of like going to the moon," Brazas says. "You get one shot at it, and we did it right."

A mishap during tapping could lead to the spilling of millions of gallons of water in just minutes and potentially shut down O'Hare. On a project like this, "You have to work with no mistakes," says Wes Brazas, Senior Resident Project Representative for Stanley Consultants. Fortunately, the deeply-anchored caissons and thrust blocks transferred the load into the ground and prevented the pipe on either side of the tap from moving laterally.

Once TDW and Stanley Consultants verified that the bypass flow was operating as required, a general contractor installed the rerouted line which connected the new 90-inch water main. The system was then switched back over from the bypass line to the relocated 90-inch line without any problems and no interruption to



The 60-inch tap inserted a custom-made folding plug head that articulated to fit snugly inside the main line. With the bypass flow operating, the general contractor installing the rerouted line connected the new 90-inch water main. The system was then switched back over from the bypass line to the relocated 90" line without incident.

Many challenges were faced during the planning and implementing of the hot tapping project. NSMJAWA stipulated that the project completion date must be met. A delay could mean tens of millions of dollars in lost revenue, not to mention that a delay at O'Hare would put a wrinkle in travel plans at other airports around the world.

Restrictions were encountered at every turn. Construction could be performed only in off-peak water usage season (October 1-April 30). Due to FAA runway protection guidelines, special permission was necessary to operate equipment over 20 feet tall. The crane work was typically performed at night when flights could be diverted to other runways.

The combination of the pipe size and the design water pressure within the pipe, in conjunction with the social and economic impacts of a successful relocation, make this one of the most complex tapping projects ever undertaken. The successful completion shows the practical and economical applications of the revolutionary method. As a result, locally one more project using this technology is underway and many more opportunities are arising nationally and abroad.

Joe Fennell is Vice President of the APWA Chicago Metro Chapter; he can be reached at (847) 981-4083 or jfennell@elkgrove.org. Robert Lewis chairs the chapter's Membership Committee; he can be reached at (773) 693-9624 or lewisrobert@stanleygroup.com.

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