

# TBM Under Ocean Waters – AvantiGrout to the Rescue

*Build it and they will come!* That was the government’s mantra to attract larger ships into the Port of Miami. However, the existing channel between Fisher Island and Miami Beach was too shallow. In order to deepen the channel, an aging sanitary sewer main belonging to the Miami-Dade County Water and Sewer Department had to be lowered.

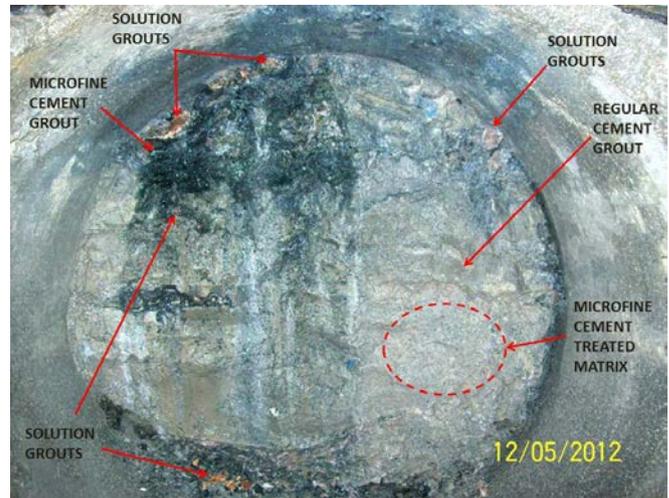


The new sanitary sewer main consists of a 54 inch HDP pipe located approximately 100 foot below the ground surface for approximately 850 linear feet. This successful design-build shaft and tunnel project was led by Ric-Man Construction (Ric-Man). An experienced contractor like Ric-Man recognized immediately that groundwater would cause problems for underground construction in and under the ocean waters of the Atlantic. Ric-man hired ECO Grouting Specialists (ECO) to design and direct a pre-excavation grouting program to facilitate the construction of three shafts planned to access the new sanitary sewer alignment tunnel. The shafts, constructed using 100 foot plus deep secant piles, were situated both on land and in the channel. The planned

tunnel would be six feet in diameter.



The geology of the area consisted of highly variable porous soft limestone, coral and silty sand. ECO developed a specially formulated grout to treat these highly variable soils and rock strata prior to the secant pile installation to provide groundwater control. This pre-excavation grouting was very successful. Upon completion, the TBM was assembled in the shaft and prepared to launch through the shaft wall. During the break-in, the geology was not as competent as expected and groundwater inflows



of 500+ gallons immediately flooded the TBM and shaft halting tunnel construction. ECO was again called upon by the Contractor to reduce the water inflow around the TBM to a manageable inflow that would allow for the break-in to occur and the tunnel liner to provide a water seal. This was a formidable grouting challenge because the TBM could not be locked in place with the grout.

The solution? A solution grout, AV-160 Acrylate by Avanti International. From previous grouting experience, it was known that the existing geologic formation was amenable to cementitious grouts, however this type of grout would provide a greater risk to grouting the TBM in place. The strength characteristics of the AV-160 were perfectly suited to encapsulate the TBM, providing a protective shell from the cementitious grout. To seal the water beyond the AV-160, Ultrafine Cement from Avanti was used to grout the erratic geology effectively sealing the water off. To accomplish this grouting procedure, various sleeve pipes were installed and packers were used to deliver the grout to isolated stages of the geology.

The grouting operation was continuously monitored with CAGES (Computer Aided Grouting Evaluation System), a real-time monitoring system, and the permeability of the subsurface was reduced to target values which reduced the inflow to less than 5gpm. The careful selection and use of the Avanti grouts allowed for the tunneling operation to resume and successfully complete the tunnel.



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