



On the Fast Track to Success

Massachusetts bypass operation fuels success for transit authority with the help of a solid pump strategy.

Boston, Massachusetts is one of the largest metropolitan areas in the United States. The city itself contains over 600,000 people, and with all of the surrounding cities taken into account, the population of the area exceeds 4 million. The city also attracts more than 12 million visitors each year who come to Boston to experience the unparalleled history and diversity that the area offers, including the ever-popular Boston Commons, South End and the famous Fenway Park. With so much history and attraction, there's no wonder transportation remains a large concern.

The Massachusetts Bay Transportation Authority (MBTA) operates the nation's oldest and 4th largest transportation system in the country. "The T", as it's known locally, was created in 1964 to run the already functioning transit system. Today it provides transportation to the entire greater Boston area by means of subways, busses, ferries and the commuter rail lines. The commuter rail provides train service to outlying points west, north, and south of Boston, including Providence, Rhode Island. The commuter rail is owned by the MBTA, but managed and operated by the Massachusetts Bay Commuter Railroad Company (MBCR).

Making Tracks

When the MBTA made the decision to extend the existing commuter rail line down the south shore, from Braintree, all the way to Scituate, it became evident that the master plan would involve far more than simply laying down 18 miles of new track. The project, referred to as the Greenbush project, a \$250 million project, faced a variety of challenges almost immediately.

One of many concerns was a decision regarding the functionality of a stretch of 48-inch pipe that belonged to the Massachusetts Water Resource Authority. As it turned out, the pipe was positioned at the exact point where a portion of the extended rail line was planned. This stretch of pipe was part of a combined sewer line, a system that allows general public and industrial waste to be combined with ground water runoff when conventional sewer systems are at capacity during times of heavy rainfall.

In order to complete the rail extension as planned, the sewer line would have to be bypassed and rebuilt at a lower elevation without disturbing the local population of the area or causing environmental impact. There was a tremendous amount of water that would have to be re-routed before re-construction of the pipe could begin.

Cashman / Balfour-Beatty (CBB) the company entrusted with completing the massive undertaking, contacted Baker Pumps.



Because of the size and importance of this bypass, CBB approached the project cautiously. With so many residents relying on a viable solution, Baker Pumps would have little margin for error. “With a bypass, what we do is interrupt the line,” Carroll Hunnewell, a regional manager with Baker Pumps explains. “We plug it off and it has no place to go. If we can’t pump it, it backs up, and then there is a chance that it can come out in the street or back up into homes.”



Potential issues with pumping also put fiscal responsibility of the project in danger. Julie Power, a Project Engineer who worked on the Greenbush project for CBB points out, “It was an active construction site. Any problem would have been a big mess to clean up. And with the environmental issues at stake, we could have faced fines for any violation. Once the pumps were installed, we needed to ensure that they would remain reliably operating to their maximum capacity so the construction team would be able to go in and complete their work in a timely fashion.”

Pumps Offer Peace of Mind

With stakes so high, one of the most practical decisions regarding the entire bypass was selecting the best pumps for the job. While pumps from several different manufacturers were considered, the project team ultimately settled on The Gorman-Rupp Company’s Prime Aire pumps. The pumps operate with a patented priming system engineered to eliminate weep-age that is associated with other vacuum-assisted primers. They also feature a dual-suction side capability, a compressor-over-pump and an abrasive handling seal. In addition to their superior mechanical quality, Power adds that the Baker Pumps and Gorman-Rupp team also pledged and provided the best service. “It was the support and the interaction with the company itself that made such a difference. It was a confidence level that we all got right away.”

To execute the pumping operation, Baker Pumps designed a siphon to direct the water down and then back up a five-foot elevation. The operation implemented seven 12-inch pumps - six primaries and one backup - which attached directly to seven 14-inch suction lines, with water being discharged 750 feet away into a 2-18” and 1-27” siphon chamber. Baker Pumps also had to deal with a 22-foot lift in elevation from the water level to the centerline of the pump at its highest point, a considerable increase from the 10-15 foot lift found on average in the New England region.

The first obstacle in the pumping stage came courtesy of Mother Nature. With the pumps selected, the plan in place and the project team ready to go, the Boston area suddenly found itself in the midst of unexpected and extreme weather. “When we were getting ready to start pumping, we were in the midst of a pretty dry time,” said Power. “That was a big plus for us. Then, once we started pumping, we hit a period of several back-to-back storms.” In fact, the Boston area, at that time, was experiencing back-to-back, 100-year storms – or periods of rainfall that have just a 1 percent chance in any given year of being equaled or exceeded.



Luckily, the Gorman-Rupp pumps were equipped to handle the increased flow. “We were aware that flows could be considerably greater than we were asked to design around,” adds Hunnewell. “But, by building a safety factor into the design of the pumping system, we were assured that the operation would continue to run smoothly during the times of heavy rainfall. Baker Pumps’ original design featured a carefully calculated safety margin so that even when the operation exceeded expected flow by upwards of 10 MGD, the Gorman-Rupp pumps continued to pump flawlessly. Later, when the weather once again changed, the pumps continued to demonstrate the ability to effectively operate in periods of extreme dryness. “When you’re doing a bypass, your flows vary dramatically. They are all over the place,”

offers Hunnewell. For this reason, it was vital that the Prime Aire pumps came equipped with dry-run capability. That way, the pumps could continue to run completely dry without any damage to the mechanical seal.



The reliability of the Gorman-Rupp pumps afforded project leaders the freedom to address issues related to other portions of the operations with the peace of mind that the pumps would not be a problem. The presence of homes and shops in the area around the bypass made noise a primary concern, as well. To address this, Baker Pumps developed a soundproof barrier around the project through the use of sound-absorbing curtains, which cut down noise level by more than 30% at a distance of 30 feet.

Even when factoring in the pumps' ability to exceed performance expectations, operate flawlessly and seamlessly and deliver upon all of their promises, CBB was most pleased with the project's bottom line. Power explains, "Our fuel costs were dramatically less than

calculated. We weren't quite certain what to expect in terms of the amount of fuel we would burn running the pumps." However, based on past experience, Baker Pumps and Gorman-Rupp anticipated that the authority would burn 3 gallons per hour per pump. But in the end, according to Hunnewell's calculations, the bypass used 1.5 gallons per hour per pump; a 50% reduction in fuel cost. This amounted to savings of nearly \$15,000 to the Greenbush Bypass Project's bottom line.

Jay Cashman's motto of "Building Things That Last" is a principal they have in common with Gorman-Rupp. "The pumps from this job came back from a 75-day operation with no visual damage or wear on them at all," adds Hunnewell. By delivering the most mechanically sound, efficient and cost effective pump for the operation, Gorman-Rupp played an integral role in the successful completion of the enormous bypass project. Power agrees, "Before the job, there was a significant level of anxiety over the potential problems. But everything ran very smoothly. We couldn't have asked for anything better."

About The Gorman-Rupp Company

Gorman-Rupp is a leading manufacturer of pumps and pumping systems for the municipal, water, wastewater, sewage, industrial, construction, petroleum, fire and OEM markets. Pumps include self-priming centrifugal, centrifugal, submersible, trash, priming assist, rotary gear and air-driven diaphragm pumps. In addition, Gorman-Rupp manufactures a complete line of packaged lift stations and booster stations, which include pumps, motors, controls, piping, accessories and enclosures. The company prides itself on manufacturing and delivering the right pump for the job.