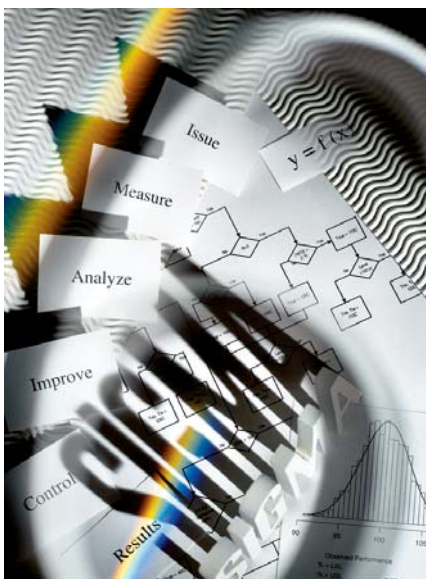


In its most significant quality improvement initiative ever, Bechtel is using **Six Sigma** to become more efficient and save its customers and itself time and money.

IN PURSUIT OF Perfection



EVERY COMPANY STRIVES FOR PERFECTION, but few go as far—or invest as much—to meet that goal as Bechtel. Last year the company devoted \$30 million to a program known as Six Sigma, with the aim of identifying and preventing rework and defects in everything from design to construction to on-time delivery of employee payroll.

Is it worth it? In a word, yes. The investment produced a savings of over \$200 million in 2002, much of which goes directly to Bechtel's customers. And the benefits should increase as more and more people throughout the organization put this program into practice worldwide.

Though it sounds like a Greek society, Six Sigma is actually a statistical approach to work management that attempts to measure and then virtually eliminate the number of defects in a given process. The theoretical goal is to get to the level known as Six Sigma, defined as no more than 3.4 defects per million measured actions (although, in many cases, it's enough just to approach that level). To put

that in perspective, let's say you've got a mail-order company selling candles and you handle 250,000 customer orders a year. At the Three Sigma level, you would make a mistake in 16,694 of them. But at the Six Sigma level, you'd get only one order wrong.

No wonder Bechtel has thrown itself into the effort. In fact, it was Chairman and Chief Executive Officer Riley Bechtel himself who pushed the company into Six Sigma after seeing its success at General Electric and Motorola. "I think it's the single most important decision that I've participated in for the last 10 years—and I think this will be important for the next 30 years," he says.

Since committing to Six Sigma in November 2000, Bechtel has trained over 10 percent of its employees as yellow belts, black belts, and champions—the people who make Six Sigma work. Yellow belts are the front line in the effort. As process owners, they learn through Six Sigma training to map work processes, and to better understand and control

BY JOHN ECKHOUSE

PHOTO-ILLUSTRATION BY TERRY LOWENTHAL



MARY MORETON MANAGES BECHTEL'S SIX SIGMA PROGRAM.

them. Black belts undergo five months of training and work full time as Process Improvement Project (PIP) team leaders. Champions drive and manage the Six Sigma process, and are responsible for making sure improvements are institutionalized across the company. In 2002, Bechtel's Six Sigma forces combined to complete nearly 300 PIPs.

"So far, Six Sigma has been fairly internally focused, but now we're working to improve customer satisfaction, reduce customer costs, and, because of that, win more contracts," says Mary Moreton, Bechtel's program manager for Six Sigma. Customers already are reaping benefits as the bulk of the savings go directly to them.

"We experienced a savings of around \$6 million in just one PIP," says Dennis Hayes, a Westinghouse Savannah River Company employee who serves as deputy area project manager for liquid waste disposition at the Savannah River Site (SRS), a former nuclear production site that Bechtel is helping to clean up.

BLACK BELT NASSER AL-TELL HELPED IMPLEMENT IMPROVEMENTS AT THE CTRL PROJECT.

Seventeen black belts have worked on 75 PIPs at SRS in the past two years. "Our return on investment is more than 300 percent to date and we're only in the early phases, so the return should go up," says Christa Wingfield, Six Sigma program manager at the site.

The savings are projected to be \$5.8 million over a five-year period in just one PIP, the High Level Waste Division's corrosion control project. A team led by black belt Peter Hill studied the process for testing 49 waste tanks for corrosion. Based on a statistical analysis of the data, the team concluded that much of the testing was unnecessary. The process was revised to reduce the number of analytical tasks by 77 percent without any impact on health and safety.

A team studying the groundwater



sampling program at Savannah River produced a five-year savings of \$2.2 million for the U.S. Department of Energy. The department shared 10 percent of that with the SRS partners as a reward for reducing its costs and used the balance of the savings to perform additional work at SRS.

Bechtel Civil's global business unit has embraced Six Sigma just as vigorously. Its investment of \$2.3 million in training has produced a return of

"I think this will be important for the next 30 years."

—Riley Bechtel

\$19.8 million so far, according to Bruce Faulkner, Six Sigma deployment coordinator for the unit in London. Of its 41 active PIPs, 27 are connected with the \$8 billion Channel Tunnel Rail Link (CTRL), a

new high-speed railway between London and the Channel Tunnel connecting Great Britain and France. Bechtel, which is a partner in the group responsible for the design, construction, and project management of CTRL, has brought Six Sigma into many aspects of the project.

"I'd never heard of Six Sigma before Bechtel's black belt brought it up, but the PIP was amazingly effective," says system-wide contract manager



PETE HILL, CHRISTA WINGFIELD, AND DENNIS HAYES (LEFT TO RIGHT) LEAD THE SIX SIGMA TEAM AT SAVANNAH RIVER SITE.

David Bennett. “We made a substantial saving in money and time, and now I’m absolutely a convert.” Bennett came to the project management team from Union Railways South Ltd., which manages one section of the project.

In a rapid and successful PIP on the CTRL project, black belt Nasser Al-Tell led a team that investigated repeated problems with the delivery of ballast—the stones that form the rail foundation. Initially, the problem was thought to be in the maintenance of the railcars used to transport the ballast. But by applying Six Sigma’s rigorous statistical measurement and analytical tools, the PIP team discovered that most of the shortfall was caused at the loading area that receives the ballast from Scotland.

“We had been putting 99 percent of our effort to solve the bottleneck at the maintenance facility, where only 3 percent of the problem lay,” Al-Tell explains. With knowledge gained from the Six Sigma analysis, the problem was attacked, and it disappeared within a few days. That produced substantial savings by avoiding cost overruns associated with construction delays.

Just as impressive was avoiding a potential \$9 million additional cost

on the tunnel ventilation system at CTRL. Another team led by Al-Tell examined the plan to build a temporary ventilation system during construction of tunnels used in the high-speed rail link. The team was composed of representatives from the customer, contractors, subcon-

tractors, and suppliers. After analyzing the design, it concluded that the permanent ventilation system could be built within the time schedule, eliminating the need to construct the costly temporary system and avoiding a project delay.

But PIPs don’t need to save huge amounts of money to prove their value. In another CTRL PIP, a team found ways to cut paperwork and reduce the time necessary to submit documentation to the project manager after completion of construction on various segments.

“I think all this shows we’re outpacing the competition yet again,” says Jude Laspa, Bechtel Deputy Chief Operating Officer and executive sponsor of Six Sigma. “We believe we are the first engineering and construction company to use Six Sigma in a major way.” 🏆

An Investment in the Future

Six Sigma black belts are selected for their demonstrated performance, strong leadership skills, and high potential. Thus, it’s likely that future leaders of the company will be skilled in Six Sigma, as well as in Bechtel’s successful Performance-Based Leadership program, which applies behavioral science to change leadership behavior and improve business results.

Despite months of training and the encouragement of senior management, serving as a black belt is not an easy task. Removed from all line responsibility, a black belt must go into an organization, pull together a multidisciplinary team, then help the group use Six Sigma tools and techniques to improve work processes.

“It can be very challenging,” says Peter Hill, a black belt at Savannah River Site, “but it’s an honor to be selected.”

Each black belt typically serves for two years, working on two or more PIPs simultaneously during that time. Then they rejoin their organization, usually at a higher level of responsibility. Though no longer responsible for PIPs, “Once a black belt, always a black belt,” says Mary Moreton, Bechtel’s program manager for Six Sigma.