

Construction, Operation and Expansion of the The Panama Canal: Past, Present and Future

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The Panama Canal has provided an essential link in world shipping routes since 1914. The first attempt to construct a canal across Panama was made by the French, beginning in 1880. Following his success in constructing the Suez Canal, Ferdinand de Lesseps raised money and support for a canal across Panama. However, the jungles of Panama proved to be a much more difficult environment than the Suez because of the very severe health problems posed by malaria and yellow fever, and because of the difficulties in excavating the unstable soils in Gaillard Cut, the southern part of the Canal.

The French were unsuccessful in controlling yellow fever and malaria. From 1880 to 1893, when the French attempt to build the Canal was abandoned, 22,000 workers were lost to these diseases. In addition, a canal at sea level would have required very deep excavations in the weak rocks encountered in the isthmus, and proved to be an overwhelming task.

The French project also suffered from mismanagement. It has been said that of the \$234 million French expenditure to construct the Canal “one-third was expended on the work, one third was wasted, and one third was stolen.” Faced with the daunting problems of disease and the necessity of excavating much larger volumes of rock than had been estimated at the outset, the French attempt was abandoned in 1893. The French equipment and interests were sold to the United States in 1902 for \$40 million.

The United States began work on the Canal in 1904, at first following in the footsteps of the French. However, it was soon realized that the problems of disease had to be

solved before the project could be successful. President Theodore Roosevelt appointed a U. S. Army surgeon, Dr. William Crawford Gargas, to be in charge of sanitation measures, as he had been previously in Cuba. By 1905, yellow fever had been eradicated in the Canal Zone and malaria was under control.

John Stevens, the engineer who had built the Great Northern Railroad across the Pacific Northwest, developed the plan that made the U. S. project successful. Stevens' design involved a canal 85 feet above sea level, with three locks at each end of the canal to lift ships to the sailing level, and then lower them back to sea level at the other end of the canal. This design reduced the volume of excavation and the heights of the slopes along the canal, making the canal possible. The redesigned project required construction of the largest earth dam that had been built up to that time (Gatun Dam) and construction of six of the largest shipping locks ever built. The dimensions of the locks – 1,000 feet long, 110 feet wide, and 40 feet deep – set the size of what were the largest ships in the world for many years, called “Panamax” vessels.

Throughout construction and since, the Panama Canal has been plagued by massive landslides that blocked shipping and required closing of the Canal many times. Landslides have occurred at 70 locations in the eight-mile-long Gaillard Cut, and repeated episodes of sliding have occurred at most of these locations. Although preventing landslides in the Panama Canal has proved to be impossible, preventing landslides from closing the Canal is essential. If shippers lose confidence in the Canal as a reliable shipping route, they will take other routes, such as shipping by rail across the United States, or across Panama.

From 1914 through 1917, the Canal was closed seven times by landslides, for a total of eight months. From 1920 through 1986, the Canal was closed four times, for a total of six days. Since 1986 there have been no closures of the Canal.

The Landslide Control Program (the LCP) was established in 1968 to address the landslide problem proactively, and has been continually revised and improved based on experience. The essential aspects of the LCP are frequent monitoring of slope movements through field observation and instrumentation, and rapid response when movements or rates of movement exceed pre-set limits. The most frequently used method of stabilizing slides is excavation to flatten the slopes. Because excavation is used so often, unit prices are low. A recent example is stabilization of the East Lirio slide in 2005, where 411,000 cubic meters were excavated at a cost of US\$950,000, or \$2.30 per cubic meter.

The Panama Canal is now fully owned and operated by Panama. On December 31, 1999 control and ownership of the Canal was transferred from the United States to Panama. Under Panamanian management, the Canal has been deepened, widened, and straightened. Owing to the widening of the Gaillard Cut portion of the Canal, two-way traffic is now possible through the full length of the Canal. Having a wider sailing prism enhances the reliability of the Canal, because a landslide that might interfere with shipping in one of the lanes will slow traffic, but not close the canal.

In October 2006 a major expansion of the Canal was approved by 80% of the electorate of Panama. The expansion, which has a budget of \$5.2 billion, will involve construction of six larger locks, and excavation of deeper channels to accommodate larger ships. The project will be financed by Canal revenue, with interim financing during construction. The new lock chambers will be 1,300 feet long, 160 feet wide, and 50 feet deep. These dimensions will make it possible for many of the new larger ships that are plying the oceans to use the Canal, and will help to ensure the viability of the Canal as a major shipping route.

I thank the following people for their help in preparing this lecture: Max De Puy and Luis Alfaro of the Panama Canal Authority, and my fellow member of the Geotechnical Advisory Board, Bob Schuster, Bill Marcuson, and Norbert Morgenstern.