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CLOSE UP: THE PANAMA CANAL, PANAMA

Panama's biggest attraction and most famous landmark, the Panama Canal stretches 80 km (50 mi) from the edge of Panama City to the Caribbean port of Colón, and a paved road follows its route between the islands of the Amador Causeway and the inland port of Gamboa. The most interesting spot for viewing the canal is the visitor center at the Miraflores Locks. North of Miraflores the road to Gamboa heads inland but still passes a couple of spots with canal vistas, namely the Pedro Miguel Locks and the one-way bridge over the Chagres River. That bridge, and Gamboa in general, offers front-row views of the big ships as they pass through the canal, since that is one of the waterway's narrowest points. The Panama Canal Railway train to Colón continues north from Gamboa past various other vantage points, which is much of the attraction of that trip. Two other spots with impressive canal views are the monument erected by the country's Chinese community on the western side of the Bridge of the Americas, and the Esclusas de Gatún (Gatún Locks), 10 km (6 mi) south of Colón. However, nothing matches the experience of the canal transit itself.

BUILDING THE PANAMA CANAL

Nearly a century after its completion, the Panama Canal remains an impressive feat of engineering. It took the U.S. government more than a decade and \$352 million to dig the "Big Ditch," but its inauguration was the culmination of a human drama that spanned centuries, and claimed, or changed, tens of thousands of lives. As early as 1524, King Carlos V of Spain envisioned an interoceanic canal, and he had Panama surveyed for routes where it might be dug, though it soon became clear that the task was too great to attempt. It wasn't until the 1880s that the French tried to make that dream a reality, but the job turned out to be tougher than they'd imagined. The Frenchman Fernando de Lesseps, who'd recently overseen construction of the Suez Canal, intended to build a sea-level canal similar to the Suez, which would have been almost impossible given the mountain range running through Panama. But a different obstacle thwarted the French enterprise: Panama's swampy, tropical environment. Nearly 20,000 workers died of tropical diseases during the French attempt, which together with mismanagement of funds drove the project bankrupt by 1889.

The United States, whose canal-building enterprise was spearheaded by President Theodore Roosevelt, purchased the French rights for \$40 million, and went to work in 1904. Based on recent advances in medical knowledge, the Americans began their canal effort with a sanitation campaign led by Dr. William Gorgas that included draining of swamps and puddles, construction of potable water systems, and other efforts to combat disease. Another improvement over the French strategy was the decision to build locks and create a lake 85 feet above sea level. A corps of engineers led by John F. Stevens and George Goethals oversaw the biggest construction effort since the building of the Great Wall of China, as tens of thousands of laborers were brought in from the Caribbean islands, Asia, and Europe to supplement the local work force. While the Americans were paid with gold,

those laborers were paid with silver and lived in crowded wooden tenements. Some 6,000 workers lost their lives to disease and accidents during the American effort, which, when added to deaths during the French attempt, is more than 500 lives lost for each mile of canal.

The most difficult and dangerous stretch of the canal to complete was Gailard Cut, named for Colonel David Gailard, the engineer in charge of digging through the rocky continental divide. Thousands of workers spent seven years blasting and digging through that natural barrier, which consumed most of the 61 million pounds of dynamite detonated during canal construction. The countless tons of rock removed from Gailard Cut were used to build the Amador Causeway and to fill in swamps that line much of the coast of what is now Panama City.

Canal construction resulted in numerous records and engineering innovations. One of the biggest tasks was the damming of the Chagres River with the Gatún Dam, a massive earthen wall 1½ mi long and nearly a mile thick. It was the largest dam in the world when built, and the reservoir it created, Gatún Lake, was the largest manmade lake. The six sets of locks, which work like liquid elevators that raise and lower ships the 85 feet between Gatún Lake and the sea, were major engineering feats. Each lock chamber is 1,000 feet long and 110 feet wide—measurements that have governed shipbuilding ever since—and water flows in and out of them by gravity, so there are no pumps. At the time of their construction, the Gatún Locks, which hold six chambers, were the largest cement structure ever built. It took four years to complete that massive structure, using mammoth forms into which concrete was poured from six-ton buckets. Between the locks and sea walls, canal construction actually caused a global cement shortage.

When the SS *Ancon* became the first ship to transit the Panama Canal on August 15, 1914, it was the culmination of a colossal effort, but work continued after that, as Gaillard Cut was widened, the lake was constantly dredged, and the locks maintained. That digging along Gaillard Cut is now more intense than ever, as Panama works toward construction of a third set of locks. As the canal approaches its 100th birthday, it remains an innovative and vital link in the global economy, and a monument to the ingenuity and industriousness of the people who built it.

LAGO GATÚN (GATÚN LAKE)

Covering about 163 square mi, an area about the size of the island nation of Barbados, Gatún Lake extends northwest from Parque Nacional Soberanía to the locks of Gatún, just south of Colón. The lake was created when the U.S. government dammed the Chagres River, between 1907 and 1910, so boats could cross the isthmus at 85 feet above sea level. By creating the lake, the United States saved years, perhaps decades, of digging that a sea-level canal would have required. After the dam's completion it took several years for the rain to fill the convoluted valleys, turning hilltops into islands, and killing vast swaths of forest, some of the trunks of which still tower over the water nearly a century later. At the time it was completed Gatún Lake was the largest man-made lake in the world. The canal route winds thorough its northern half, past several forest-covered islands, the largest of which is Barro Colorado, one of the world's first biological reserves. To the north of Barro Colorado are the Islas Brujas and Islas Tigres, which together hold a Primate Refuge—visitors are not allowed. The underwater world is home to crocodiles, manatees, and peacock bass, a species introduced from South America that is popular with fishermen.

CANAL FACTS

More than 14,000 vessels under the flags of some 70 countries use the canal each year.

A boat traveling from New York to San Francisco saves 7,872 mi by using the Panama Canal instead of going around Cape Horn.

Most ships take 8–10 hours to traverse the canal, but the U.S. Navy hydrofoil *Pegasus* holds the record for the fastest transit at 2 hours and 41 minutes.

Most of the canal lies at 85 feet above sea level, which is why three locks are needed to raise and lower ships on either end of it.

Each of the canal's locks is 1,000 feet long and 110 feet wide, dimensions that have governed shipbuilding since the canal's completion in 1914. The massive Panamax ships that move most cargo through the canal are designed to carry as much as possible while still fitting into the locks.

For each large ship that passes through the canal, 52 million gallons of fresh water are used by six locks, and more than 1 billion gallons of water flow from the canal into the sea every day. (It's a good thing the canal was built in a rain forest.)

The highest toll for Panama Canal passage was \$249,165.00, paid by the container ship *Maersk Delys* on May 30, 2006, though that record may have been broken by the time you read this.

The lowest toll on record was the \$0.36 paid by Richard Halliburton, who swam the canal in 1928. Halliburton's record is safe for posterity, since tolls have risen considerably since then.

Panama Canal & Surroundings

