TOP 10 MOST IMPRESSIVE CIVIL ENGINEERING PROJECTS OF ALL TIME

10

Qingdao Haiwan Bridge

Qingdao, China | 2011

4 years
+
10,000 workers to build

3 million

Reuters

With a total length of 26.4 miles (*42.5 km*), the bridge is currently the *Longest Bridge in the World* in aggregate length

BEIJING
QINGDAO
CHINA
SHANGHAI
HONG KONG

The Qingdao Haiwan Bridge connects the city of Qingdao in Eastern China with the Huangdao suburbs, across the waters of Jiaozhou Bay

cu. yd
(2.3 million cu. m)
of concrete

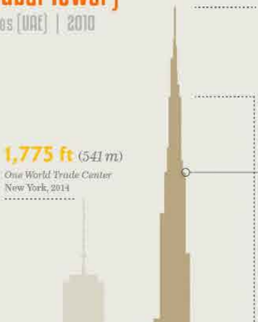
450,000 tons of steels

It is built to withstand typhoons, earthquakes up to 8.0 on the Richter scale, and impacts of 300,000 ton vessels

09 Burj Khalifa [Dubai Tower]

Dubai, United Arab Emirates [UAE] | 2010

Standing at 2,717 ft (*828 m*), the tower is currently the *Tallest Building* and the *Tallest Free-standing Structure* in the world



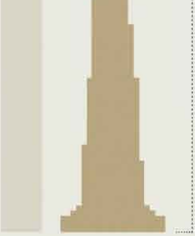
1,775 ft (*541 m*)
One World Trade Center
New York, 2014

2,717 ft (*828 m*)

163 floors
163 floors are habitable, covering a floor area of 3.3 million square feet

27 terraces
The building's setback design creates 27 terraces

99 miles/hr wind speeds
(*160 km / hour*)



Strong winds were such an engineering obstacle that over 40 wind tunnels tests were conducted to determine the wind's impact on the building and construction cranes

22,000,000 man hours

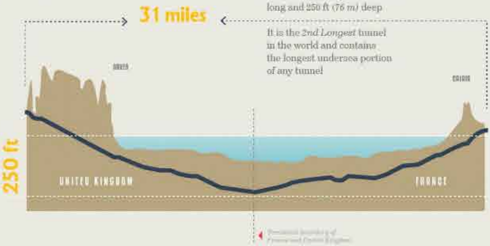
Over 22 million man hours went into building the tower and some of the building was completed at night – including pumping concrete almost 2,000 ft up – to avoid the high daytime temperatures

08

English Channel Tunnel

English Channel, Strait of Dover | 1994

Named one of the 7 *Wonders of the Modern World* by ASCE



The tunnel is 31 miles *(50 km)* long and 250 ft *(76 m)* deep

It is the *2nd Longest* tunnel in the world and contains the longest undersea portion of any tunnel

The high speed trains move so quickly that valves in the tunnel walls open and close to vent the pressure that builds up as the trains push air through the tunnel

6 years
+
13,000 engineers, technicians, construction workers
+
11 tunnel-boring machines
to build

07

Golden Gate Bridge

San Francisco, CA | 1937

GOLDEN GATE BRIDGE
MAIN SPAN
4200 FEET

27,572 strands

80,000 miles long

Each of the bridge's two main cables

Named a *Historic Civil Engineering Landmark* by ASCE

GOLDEN GATE
PACIFIC OCEAN
SAN FRANCISCO

is made of 27,572 strands of wire and together the wire is roughly 80,000 miles (*128,747 km*) long

600,000 rivets

The bridge required *600,000* rivets to build

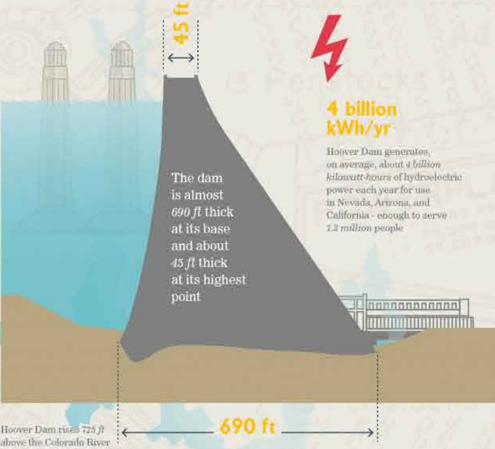
The almost 1.3 mile (*2.1 km*) wide "Golden Gate" strait, strong winds, and earthquakes all posed significant obstacles to building a bridge that would connect San Francisco to the rest of the bay

06 Hoover Dam

Colorado River, AZ | 1936

Named one of the *7 Wonders of the Modern World* and a *Historic Civil Engineering Landmark* by ASCE

A Millennium Monument, achievements that had the greatest positive impact on life in the 20th century



The dam is almost *690 ft* thick at its base and about *45 ft* thick at its highest point

4 billion kWh/yr

Hoover Dam generates, on average, about *4 billion kilowatt-hours* of hydroelectric power each year for use in Nevada, Arizona, and California - enough to serve *1.3 million* people

LAKE MEAD
BLACK MOUNTAINS
93
HOOVER DAM
COLORADO RIVER

Hoover Dam rises *725 ft* above the Colorado River and resulted in the creation of *Lake Mead*, the largest man-made lake in the Western Hemisphere

05 Panama Canal

Panama | 1914

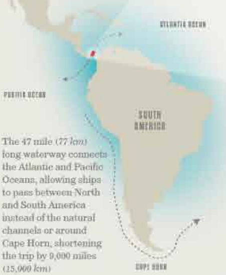
ATLANTIC OCEAN
Canal
Locks
Railway
REPUBLIC
OF
PANAMA

urrier.wordpress.com

REPUBLIC
OF
PANAMA
PANAMA
PACIFIC OCEAN

1904 Panama Canal map courtesy of geology

Named one of the 7 *Wonders of the Modern World* and a *Historic Civil Engineering Landmark* by ASCE



The 47 mile *(77 km)* long waterway connects the Atlantic and Pacific Oceans, allowing ships to pass between North and South America instead of the natural channels or around Cape Horn, shortening the trip by 9,000 miles *(15,000 km)*

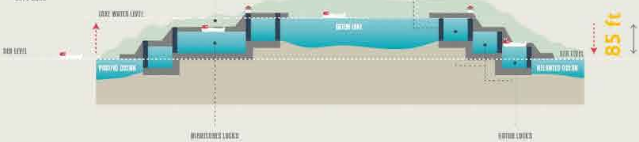
The marvel

The ship must be lifted on one side and lowered on another side by 85 feet *(26 m)*

more than 15,000 ships cross the Canal every year

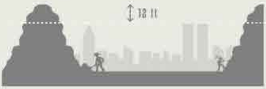
750 tons

Each of the movable lock doors weighs *750 tons* and fills with *52 million gallons of water* to accommodate the more than *15,000 ships* using the canal every year



60 million lbs.

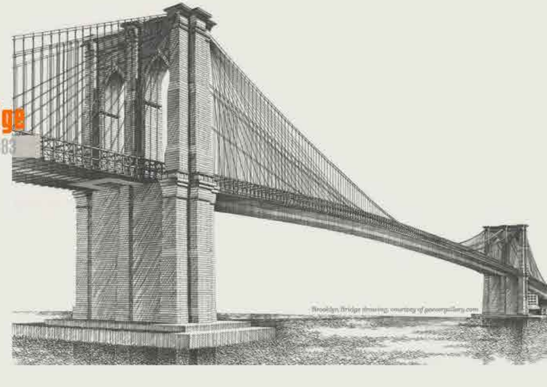
More than 60 million pounds of dynamite were used to build it and *40,000 workers* moved enough dirt to bury all of Manhattan *12 ft deep*



A project is currently underway to expand the canal with a third set of locks that will allow for bigger ships to use the canal

04 Brooklyn Bridge

Brooklyn, New York | 1883



Brooklyn Bridge drawing, courtesy of [illegible].com

The Brooklyn Bridge is notable for being:

The first suspension bridge to use steel for its cable wire

The first to use explosives in a dangerous underwater foundation system called a *Caisson*

The longest suspension bridge in the world (*3,460 ft*) at the time it was built

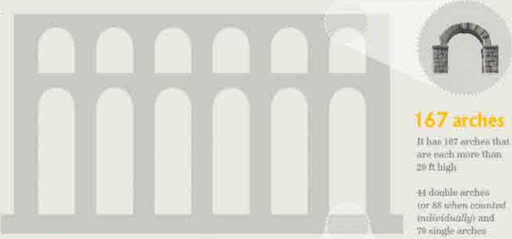
Before the project began, the chief engineer died, and the job was taken over by his son, *Washington Roebling* who oversaw most of the bridge's construction without ever leaving his apartment due to a crippling decompression sickness

144,000 vehicles a day

Today, the Brooklyn Bridge is the 2nd busiest bridge in New York City with 144,000 vehicles crossing the bridge every day

03 Aqueduct of Segovia

Segovia, Spain | 50 A.D.



167 arches

It has 167 arches that are each more than 29 ft high

44 double arches *(or 88 when counted individually)* and 79 single arches

BUILT 50 A.D.

The aqueduct is designed to transport water from the Fuente Fría river, situated in the nearby mountains, some 11 miles (*17 km*) from the city in La Acebeda region. It runs another 9.3 miles (*15 km*) before arriving in the city

AMERICAN SOCIETY OF CIVIL ENGINEERS 1852

Named by the **American Society of Civil Engineers** (ASCE) as a *Historic Civil Engineering Landmark* in 1999

Built during the reign of Roman Emperor Trajan, the aqueduct is preserved so well that it is still used today

24,000 blocks

The bridge consists of 24,000 granite blocks made without the use of mortar

02 Great Wall of China

China | 475 B.C. - 15th Century C.E.

Over 2,000 years, a series of several walls were built, rebuilt, merged

475 B.C.E.

Construction began in 475 BC to protect China from invading Huns

5,500 miles

were built, rebuilt, merged, and expanded to create the wall as it stands today, completed between the 15th and 17th century

The wall is 5,500 miles long *(8,850 km)* and can not actually be seen from space

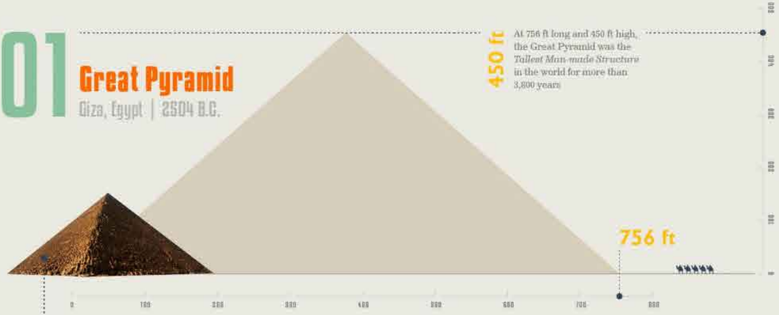
The mortar used to bind the stones of the wall is made from rice flour.

3,215 ft

Some of the watchtowers stand 3,215 ft *(980 m)* above sea level and the wall reaches 25.6 ft *(7.8 m)* in height and 16.4 ft *(5 m)* in width in the Juyongguan pass

01 Great Pyramid

Giza, Egypt | 2504 B.C.



450 ft

At 756 ft long and 450 ft high, the Great Pyramid was the *Tallest Man-made Structure* in the world for more than 3,800 years

2.3 million

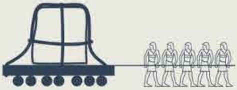
The pyramid consists of 2.3 million stone blocks

2.5 tons

Average weight of each stone block

30,000

Estimated number of workers required to build the pyramid



25-80 tons

The largest stone blocks weigh between 25 and 80 tons and were transported from almost 500 miles *(800 km)* away

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