LEGO Architecture

The Leaning Tower of Pisa

Pisa, Italy

The Leaning Tower of Pisa

The Leaning Tower of Pisa (Torre pendente di Pisa) took almost 200 years to complete and has stood beside the Cathedral of Pisa for over 600 years. Thanks to its famous tilt, it has become one of the world's most recognizable architectural landmarks. The story behind the bell tower spans over 800 years of European history and provides a fascinating glimpse into a miracle of medieval engineering.

History

The story of the tower of Pisa begins in January 1172 when the widow Berta of Bernado left 60 soldi (gold coins) in her will to purchase stones for the construction of a bell tower. A year later, in August 1173, the first foundations for the tower were laid in the ground behind the existing Pisa Cathedral.

At that time, Pisa was a rich, independent trading port and it was hoped that the new tower would become a symbol of a city at the height of its cultural and economic power. Therefore the circular, freestanding tower was designed to be one of the tallest in Europe and included finely elaborately carved columns and intricate bas-reliefs.

Within five years, and with only two floors completed, the builders faced a serious obstacle – a combination of shallow foundations and soft, unstable subsoil was causing the tower to lean. Construction was stopped, and with Pisa's prosperity and power on the decline, a hundred years would pass before building was resumed. Four more floors were added in 1272, the seventh floor in 1319 and the bell-chamber in 1372. On completion, the tower would stand 185 ft. (56.4 m) tall and consist of eight stories, including the bell-chamber. A total of seven bells, one for each note of the musical scale, were installed – adding even more weight to the already heavy structure. Throughout the construction period, and especially during the last one hundred years, many have tried to solve the tower's overriding structural problem, more often than not, making the problem worse. It would be 2008 before engineers could confirm that the tower had stopped moving for the first time in its history.

Construction

While the Tower of Pisa is most known for “leaning”, it would still be a remarkable architectural structure without this famous feature. Constructed at a time when there was very little building of this kind being carried out in Europe, the intelligent use of columns and arches demonstrates an in-depth understanding of weight and load characteristics that was way ahead of its time.

What the architect overlooked however, was the clay-based soil and the need for a foundation capable of supporting a bell tower that would eventually weigh 16.000 tons (14.500 metric tons).

The eight-story tower was built with limestone and lime mortar, with an exterior covering of marble. Interestingly, the limestone is probably why the tower has not cracked and collapsed – the rock is flexible enough to withstand the pressures placed on it by the tilt. The bottom story of the tower is an arcade of 15 closed marble arches. Each of the following six stories contains 30 arches, while the final story, or bell-chamber, has 16 arches.

Many of the attempts to rectify the tower’s leaning are just as interesting as the actual construction itself. After work resumed on the tower in 1272, engineers attempted to compensate for the tilt by building the upper floors with one side taller than the other. However, the weight of the extra floors caused the edifice to sink further and lean more.

In 1934, 362 holes were drilled in the base of the tower and filled with 99 tons (90 metric tons) of cement, with almost disastrous consequences. In the early 1990s, the tower was closed to the public and engineers anchored the tower to the ground using high tensile steel cable in an attempt to stabilize it. After two decades of corrective reconstruction and stabilization efforts, it was announced in 2008 that the tower had been stabilized to such a degree that it had actually stopped moving for the first time in its history. It is now claimed that the tower will remain stable for at least 200 years.

Prior to this final restoration work, the tower leaned at an angle of 5.5 degrees. It now leans at 3.99 degrees. This means that the top of the tower is displaced horizontally by 12 ft. 10 in (3.9 m).

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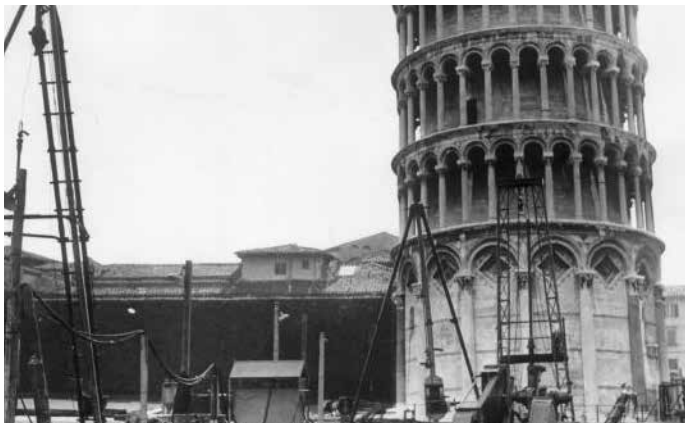

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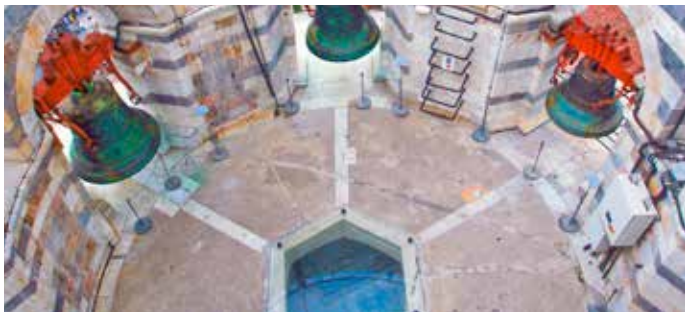
Today

The Leaning Tower of Pisa remains an iconic architectural landmark and a true feat of medieval engineering. Though more famous for its tilt, the true wonder of the tower is that it still stands after 800 years.

In 1987, the entire Piazza del Duomo (Cathedral Square) – also known as Piazza Dei Miracoli (Field of Miracles) – including the tower as well as the Cathedral and baptistery was declared a Unesco World Heritage Site. This was an acknowledgement of the unique nature of the site and its importance as one of Italy’s most popular tourist attractions.



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Architects

The identity of the Leaning Tower of Pisa’s first architect remains a mystery. For many years, the initial phase of the design work was attributed to Bonanno Pisano, a well-known 12th-century resident artist of Pisa. However, recent studies appear to indicate that an architect named Diotisalvi, who designed the baptistery, was also responsible for the tower.

The second phase of construction is attributed to Giovani di Simone, who added four floors to the tower in 1275. Architect Tommaso di Andrea Pisano (1350-1372) was the architect who finished the work and succeeded in harmonizing the Gothic elements of the bell-chamber with the Romanesque style of the tower.

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Facts about The Leaning Tower

Location:	Pisa, Italy
Architects:	Various
Date:	Started 1173 – Completed 1399
Construction type:	Bell Tower
Architectural Style:	Romanesque Tower/Gothic Bell Chamber
Materials:	Limestone, Lime mortar, Marble exterior
Height:	8 stories, 185 ft. (56.4 m)
Diameter of base:	50 ft. 9.6 in (15.484 m)
Weight:	16,000 tons (14,500 metric tons)
Angle of tilt:	3.97 degrees 12 ft. 10 in (3.9 m) from vertical

Facts and statements

At only 185 ft. (56.4 m), the Leaning Tower of Pisa is the smallest "tower" to achieve worldwide recognition.

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There are 207 individual columns ranged around the eight-storey tower.

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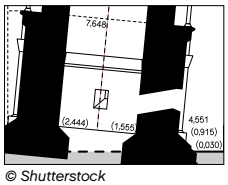
The foundation of the tower is only 10 ft. (3 m) deep, a key contributing factor to its famous tilt



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The first bell was placed in the tower in 1198.

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On the upper floors, one side is taller than the other. As a result, the tower is actually curved.

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The tower has 296 or 294 steps; the seventh floor has two fewer steps on the north-facing staircase.

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The bell-chamber incorporates a built-in 5.5 in (14 cm) correction in relation to the tower's lean.

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A Word from the Artist

"As an architectural artist, my desire is to capture the essence of a particular architectural landmark into its pure sculptural form. I first and foremost do not view my models as literal replicas, but rather my own artistic interpretations through the use of LEGO® bricks as a medium.

In an attempt to appeal to the vast admirers of the Leaning Tower of Pisa, our specific aim was to ensure that it could be both afforded and constructed by anyone looking to enjoy displaying a miniature Pisa Tower they can call their own. To do so, I needed to adhere to a minimal element/part pallet, which would affect the model's scale, level of detail and construction techniques while maintaining structural integrity.

Exploring different, creative solutions and incorporating artistic license makes it possible to capture the essence of the structure without sacrificing its identity. Once the identifiable features, subtle details, and overall form were completed, I turned my attention to accomplishing the task of what color would best represent the building materials used in the real structure. The color selection turned out to be rather effortless since white was the clear choice for representing the tower's white Italian marble from Carrara."

Adam Reed Tucker

The Leaning Tower of Pisa model was created in close collaboration with the LEGO design team. They look at the model from a LEGO building point of view and ensure the construction process is simple logical, and a positive experience for the user.

The 'Scale Model' line – LEGO® Architecture in the 1960s

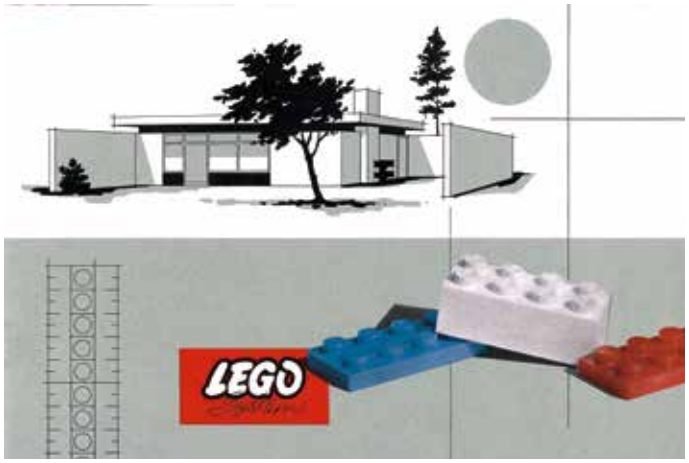
The history of the current LEGO Architecture series can be traced back to the beginning of the 1960s, when the popularity of the LEGO brick was steadily increasing. Godtfred Kirk Christiansen, the then owner of the company, began looking for ways to further expand the LEGO system and asked his designers to come up with a set of components that would add a new dimension to LEGO building.

Their answer was as simple as it was revolutionary: five elements that matched the existing bricks, but were only one third the height. These new building "plates" made it possible to construct more detailed models than before.

This greater LEGO flexibility seemed to match the spirit of the age; modernist architects were redefining how houses looked and people were taking an active role in the design of their dream homes. It was from these trends that the LEGO 'Scale Model' line was born in early 1962.

The name itself was a direct link to the way architects and engineers worked and it was hoped that they and others would build their projects 'to scale' in LEGO elements. As with LEGO Architecture today, the original sets were designed to be different from the normal, brightly colored LEGO boxes, and also included 'An Architectural Book' for inspiration.

Though the five elements remain an integral part of the LEGO building system today, the 'Scale Model' line was phased out in 1965. Many of the principles from the series would re-emerge over 40 years later in the LEGO Architecture series we know today.



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