

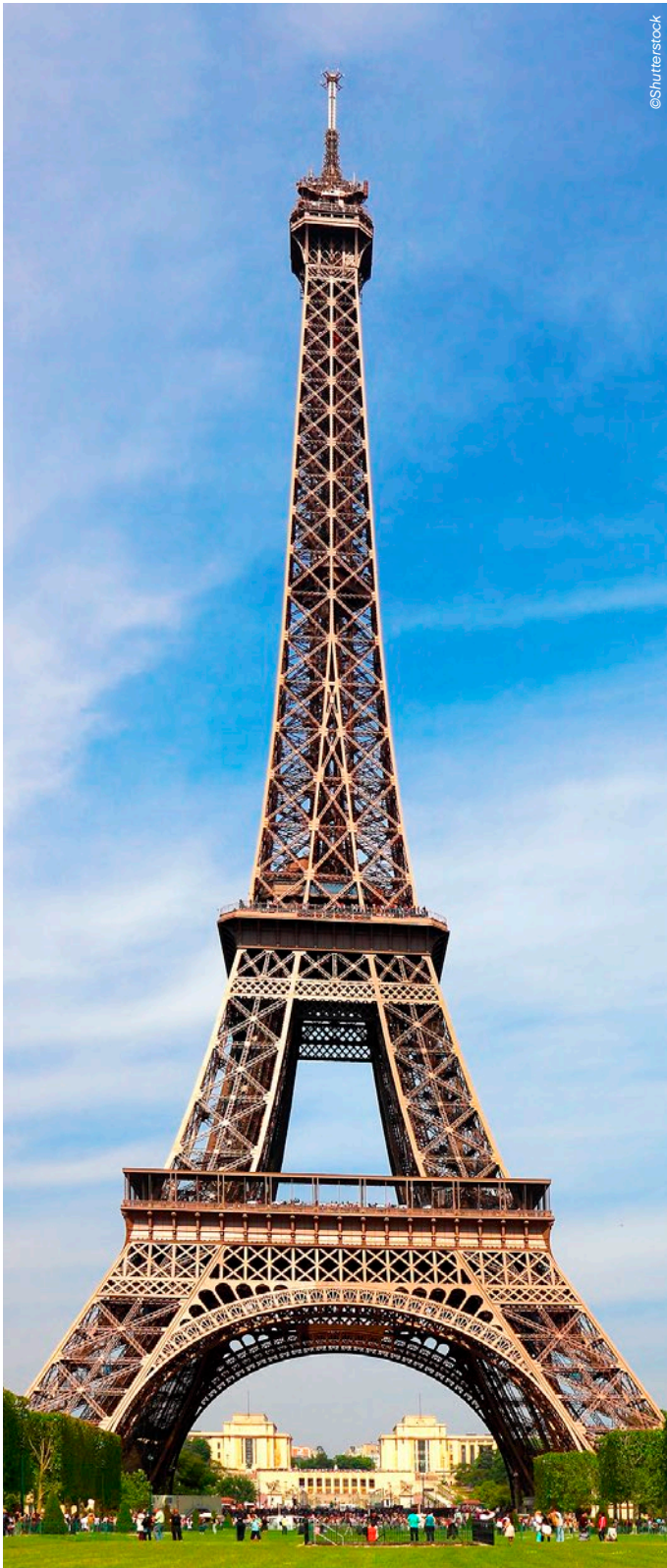


Architecture

The Eiffel Tower

Paris, France





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The Architect

Born on December 15, 1832, in Dijon, Gustave Eiffel was an exceptionally gifted engineer and builder. He graduated from the École Centrale des Arts et Manufactures in 1855, the same year that Paris hosted the first World's Fair. He spent several years in southwestern France, where he supervised work on the great railway bridge in Bordeaux. In 1864, he set up in his own right as a "constructor," specializing in metal structural work.

Eiffel would go on to build hundreds of different types of metal structures all around the world. Bridges, and particularly railway bridges, were his favorite field of work, but he also won renown for his metal structural work and industrial installations. His career was marked by a large number of fine structures and buildings, two of the most outstanding being the twin edifices of the Porto viaduct and the Garabit viaduct in the Cantal region of France.

Equally outstanding are the other structures where the pure inventiveness of Eiffel's company was allowed free rein, such as the "portable" bridges sold around the world as "kits," and the ingenious structure of the Statue of Liberty in New York. His entrepreneurial career culminated in 1889 with the completion of the Eiffel Tower.

Two years earlier, in 1887, Eiffel had agreed to build the locks of the Panama Canal. It was an immense undertaking, but the project was badly managed and went on to become one of the biggest financial scandals of the century.

After clearing his name, Eiffel retired to devote the final thirty years of his life to scientific research. He died on December 27, 1923, at the age of 91.



The Eiffel Tower

The Eiffel Tower (La tour Eiffel) is the famous iron lattice structure located on the Champ de Mars in Paris, France. It is named after the engineer, Gustave Eiffel, whose company designed and built the tower as the entrance to the 1889 Exposition Universelle, or World's Fair. The tower is one of the most recognizable structures in the world and has become an iconic symbol of both Paris and France.

[Can one think that because we are engineers, beauty does not preoccupy us or that we do not try to build beautiful, as well as solid and long lasting structures?]

Gustave Eiffel

History

In 1889 Paris hosted a World's Fair to mark the 100-year anniversary of the French Revolution. Three years before, an official competition had been launched to find a suitable centerpiece for the exhibition. Gustave Eiffel's plan for a 985-foot (300-meter) tall iron tower was selected from among the 107 different projects submitted.

Two chief engineers from Eiffel's company, Maurice Koechlin and Emile Nouguier, had already been working on an idea for an iron tower since 1884. Their design was based on a large pylon with four columns of latticework girders, separated at the base and coming together at the top. The four columns would be joined together by metal girders at regular intervals.

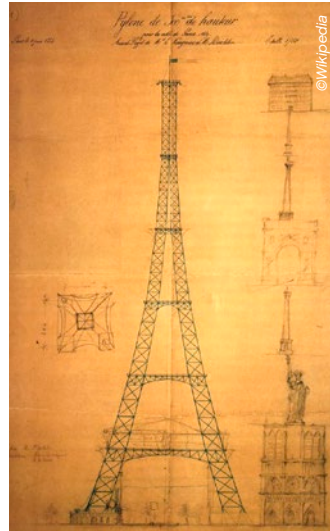
In order to make the proposed project more acceptable to public opinion, Nouguier and Koechlin turned to the head of the company's architectural department, Stephen Sauvestre, and asked him to work on the tower's overall appearance.

Sauvestre proposed stonework pedestals to dress the legs, and added decorative arches to link the columns at the first level. He also suggested a bulb-shaped design for the top and various other ornamental decorations, but these were rejected to create the simplified appearance we recognize today.

While Gustave Eiffel believed the structure would symbolize "not only the art of the modern engineer, but also the century of Industry and Science in which we are living," the proposed tower soon attracted criticism. Many of the country's leading art figures campaigned against it, calling the structure both "useless and monstrous," and a "hateful column of bolted sheet metal!"

Many of the protestors, however, changed their minds once the tower was built, and today it is widely considered to be a striking piece of structural art.

When the main work was completed in March 1889, Eiffel led a group of government officials, accompanied by representatives of the press, to the top of the tallest structure in the world. Since the elevators were not yet in operation, the ascent was made by foot, and took over an hour. Here Eiffel unfurled a large Tricolore to the accompaniment of a 25-gun salute.



An early sketch of the tower from circa 1884



The tower lights up the World's Fair



The tower as a gateway to the World's Fair



The tower under construction in 1888

Design and Construction

It took an enormous amount of preparatory work before construction on the tower could begin. The company's drawing office produced over five thousand drawings describing the complex angles involved and the degree of precision needed to join the 18,038 individual iron parts together. Work on the foundations started in January 1887, and by the end of June the four pedestals were ready. The assembly of the tower began on July 1, 1887, and after two years, two months, and five days, the structure was completed.

All the elements were prepared in Eiffel's factory located at Levallois-Perret on the outskirts of Paris. Each individual piece was traced out to an accuracy of a tenth of a millimeter and then connected to the other pieces to form larger elements approximately 16.4 feet (5 meters) in length.

First the pieces were assembled in the factory using bolts, later to be replaced one by one with thermally assembled rivets, which contracted during cooling to ensure a very tight fit. The pieces were hauled up by steam cranes, which themselves climbed up the tower as they went along, using the runners intended for the tower's elevators. Hydraulic jacks – replaced after use by permanent wedges – allowed the metal girders to be positioned to an accuracy of 0.04 inch (1 millimeter).

As the tower neared completion, many people were alarmed by its daring design and criticized Eiffel for not paying enough attention to the engineering challenges involved in building the world's tallest structure. Eiffel and his engineers were, however, masters of building complex iron bridges, and, for them, the tower project was a natural extension of the company's earlier pioneering work.



It took two years, two months, and five days to complete the tower



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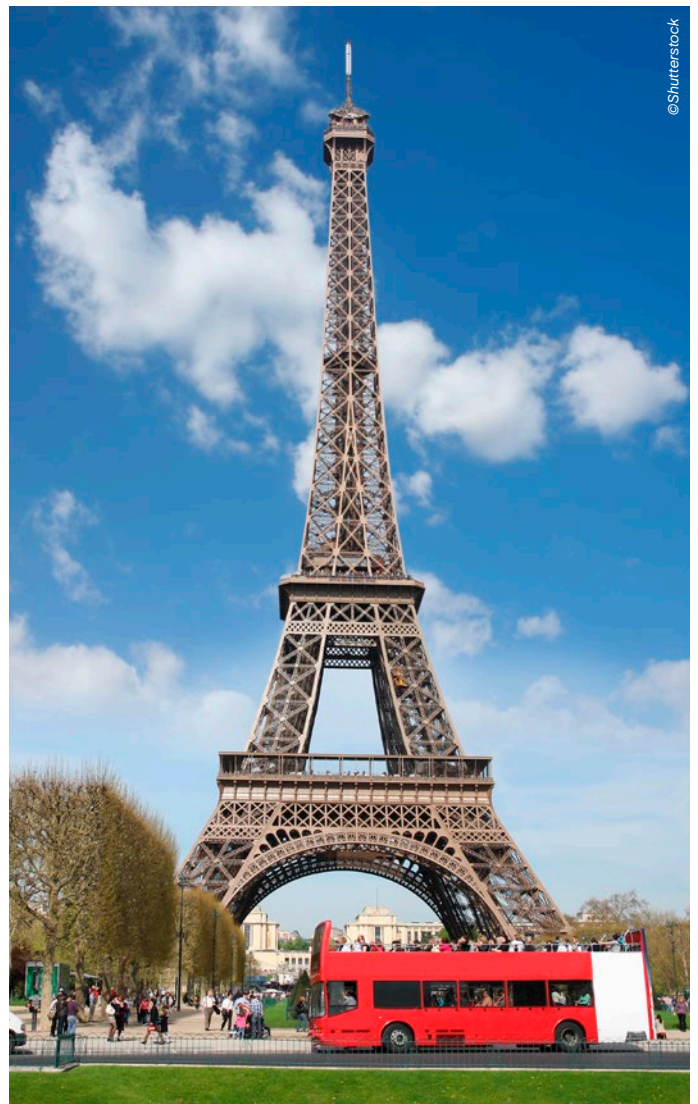
From 1889 to Today

The tower was an immediate success with the public, and lengthy queues formed to make the ascent. Tickets cost two francs for the first level, three for the second, and five for the top, with half-price admission on Sundays. By the end of the 1889 World's Fair, there had been nearly two million visitors.

Eiffel had a permit for the tower to stand for twenty years; it was to be dismantled in 1909, when its ownership would revert to the city of Paris. The city had originally planned to take it down (part of the original contest rules for designing the tower was that it could be easily demolished), but Eiffel argued that the structure was valuable for communication and scientific purposes. After a short campaign, it was allowed to remain after the original permit expired.

Eiffel installed a meteorology lab on the third floor and later also constructed a small wind tunnel at the foot of the tower. He carried out five thousand tests there and encouraged others to use the tower to study subjects such as meteorology, astronomy, and physics. It was the advent of wireless telegraphy that finally secured the structure's future. The top of the tower would be modified over the years to accommodate an ever-growing number of antennas. It is currently home to 120 antennas, plus a television mast that extends the height of the tower to 1,063 feet (324 meters).

Today the Eiffel Tower remains one of the most recognizable structures on the planet, welcoming more visitors than any other paid monument in the world—an estimated seven million people per year. Some five hundred employees are responsible for its daily operation, ensuring that eager crowds enjoy panoramic views of the city.



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Facts about the Eiffel Tower



Location: Paris, France
People: Entrepreneur: Gustave Eiffel
Engineers: Maurice Koechlin and Emile Nouguier
Architect: Stephen Sauvestre
Materials: Wrought iron with stonework pedestals
Construction: Started January 1887 –
completed March 1889
Number of iron parts: ... 18,038
Weight: Iron structure: 8,047 tons (7,300 metric tons)
Total structure: 11,133 tons (10,100 metric tons)
Height: Initial height: 1,024 feet (312 meters)
(to the top of the flagpole) –
Current height (including antennas):
1,063 feet (324 meters)
Cost of construction: 7,799,401.31 French gold francs (1889)

Facts and Statements



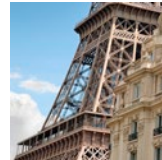
The tower's 18,038 individual iron parts are held together by a total of 2,500,000 rivets.

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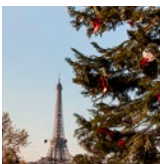
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The position of each of the 2,500,000 rivet holes was specified to within 0.04 inch (0.1 millimeter).



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The tower sways slightly in the wind. During a storm in 1999, it moved approximately 5.12 inches (13 centimeters) from its initial position.



The Eiffel tower is open 365 days a year and welcomes almost seven million visitors annually.

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The Eiffel tower is repainted every seven years. It takes twenty-five painters between fifteen and eighteen months to complete the work.



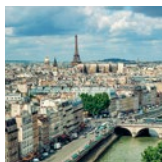
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The tower can be affected by heat. When a part of the structure is exposed to the sun it expands, causing the tower to lean as much as 7.08 inches (18 centimeters).



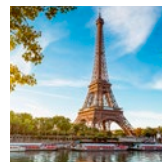
If the 8,047 tons (7,300 metric tons) of the metal structure were melted down, it would fill the 125-meter-square base to a depth of only 2.36 inches (6 centimeters).

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The tower remains the tallest structure in Paris, and from 1889 to 1930 was the tallest structure in the world.



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In order to enhance the impression of height, three separate colors of paint are used on the tower, with the darkest on the bottom and the lightest at the top.

The “Scale Model” Line – LEGO® Architecture in the 1960s

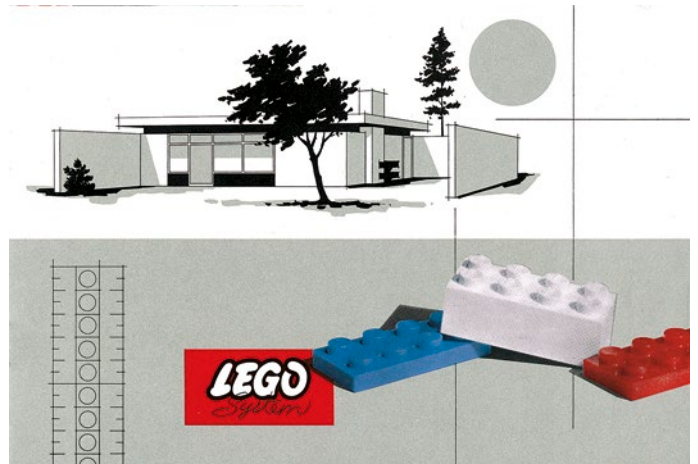
The history of the current LEGO® Architecture series can be traced back to the beginning of the 1960s, when the popularity of the LEGO brick was steadily increasing. Godtfred Kirk Christiansen, the then owner of the company, began looking for ways to further expand the LEGO system and asked his designers 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 interest in the design of their new homes. It was these trends that led to the introduction of the LEGO ‘Scale Model’ line 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 forty years later in the LEGO Architecture Series, the LEGO Architecture Series we know today.



A joint project by the LEGO Group and United Nations

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