

# France

## Did you know ...?

- There were more than 5,300 plans and drawings for the Tower
- The Tower was built in 2 years, 2 months and 5 days, from 1887 to 1889. It was an instant financial success.
- There were 18,000 components, made by 100 ironworkers off-site, then assembled by 130 workers on-site.
- It measures 410 feet (125 m) on each side and stands 1,024.5 feet (312.27 m), and weighs 9,500 tons
- The tower sways only 4.5 inches at the top.
- For many years, the Tower was the world's tallest structure with a safety elevator designed by Otis
- Not one fatality occurred during construction.
- Guy de Maupassant, Alexander Dumas, Emile Zola, and other luminaries signed a petition objecting strenuously to the Tower
- Eiffel also designed the iron framework inside the Statue of Liberty.

"We, the writers, painters, sculptors, architects and lovers of the beauty of Paris, do protest with all our vigor and all our indignation, in the name of French taste and endangered French art and history, against the useless and monstrous Eiffel Tower." Clearly, initial reaction to the Tower was mixed, as evidenced by this quote from a petition presented to the government of the City of Paris. The petition was signed by—among others— Guy de Maupasssant, Alexander Dumas, Emile Zola, Charles Gounod, and Paul Verlaine.

Paris's soaring, open-lattice, wrought-iron Eiffel Tower, originally built for the International Exposition of 1889 commemorating the centennial of the French Revolution, remains a universally recognized symbol of France, and indeed all Europe. Over 700 proposals had been submitted by architects, engineers, sculptors, and artists. One was selected unanimously, the design by Gustave Eiffel.

The tower became an instant icon, the site of many romantic moments, as well as staggering feats of individual bravado. In 1923, the man who would become Mayor of the district of Montmartre showed his derring-do by bicycling down the tower using its legs as a ramp! In 1954, a mountain climber scaled its height, and in 1984 two English chaps parachuted from the top.

#### HISTORY

The plan for the tower was submitted to the design competition by the civil engineer Gustave Eiffel (1832-1923), already well-known for such works as the arched Gallery of Machines for the Paris Exhibition of 1867, the dome for the Nice Observatory, a harbor in Chile, a 541-foot arched bridge in Garabit, France, a pre-constructed spanned bridge in China, and an iron bridge at Bordeaux (the construction of which involved the first use of compressed air to drive piles). Eiffel's viaduct over the Truyère, which stretched 1,850 feet (564 meters), with a central arch span of 541 feet (165 meters), constituted an engineering record: with a height of 400 feet (122 meters) over the river, it was for years the world's highest bridge.

While Eiffel receives all the credit for the tower, it must be noted that the original conception for the 1889 exposition tower came from two engineers at Eiffel's firm: Maurice Koechlin and Emile Nouguier. It took years of work by more than fifty engineers and designers to prepare the approximately 5,300 plans and drawings for the tower.

Reproduced here is the official agreement of January 8, 1887, which outlines Gustave Eiffel's construction and operation of the tower. In addition to Eiffel, it was signed by Commerce and Industry Minister, Edouard Lockroy, who, as commissioner general of the Exposition, organized the design competition, and by Eugène Poubelle, prefect of the Seine.

Once approval was given, the project proceeded at a rapid pace. Excavation commenced on January 26, 1887, and assembly of the metal structure on July 1. The tower's 18,000 component parts were made by more than 100 ironworkers at the workshops of Eiffel's company in the outskirts of Paris, and were assembled by more than 130 workers at the exposition site.

The exposition was scheduled to open on May 6, 1889. Contrary to the expectations of many observers, Eiffel easily fulfilled his commitment to complete the project on schedule, finishing on March 30, 1889. In a ceremony the following day, a small group of dignitaries accompanied Eiffel to the top

where he raised a huge French flag with the letters "R. F." (République Française), and was awarded the Legion of Honor.

The tower rises from a square base measuring 410 feet (125 meters) on each side, to a height of 1,024.5 feet (312.27 meters) (even higher today because of the addition of broadcasting antennas). Until the completion in 1930 of New York City's Chrysler Building, the Eiffel Tower had been the tallest man-made structure in the world. Despite its immense height, the tower weighed approximately 9,500 tons, with the metal framework accounting for 7,300 tons. Because of its cross-braced, latticed structure, wind had little impact on its stability.

The Eiffel Tower was an immediate success. Construction costs, said to be approximately 8 million gold francs, were quickly covered by receipts earned from visitors. By the time the fair closed in early November 1889, two million people had visited the tower. By the end of that year, receipts totaled 5.9 million gold francs. As of 2002, the total number of visitors to the tower had exceeded 200 million.

#### **CULTURAL CONTEXT**

France is the country that coined the phrase *Les Grands Travaux* (Large-scale Engineering Works). In a French encyclopedia, an article on *Le Canal des Deux Mers* (The Canal of the Two Seas) states that the Canal was the greatest public work since the time of the ancient Romans. Thus, Eiffel was in the authentic tradition of *Les Grands Travaux*. Perhaps the world's greatest artist in the medium of iron, Eiffel also wrote a book entitled *L'Architecture Métalique*.

He attended the Ecole Centrale, a school for the arts and manufacturing. But if his school prepared him for art, he also participated in its manufacturing mission, as Eiffel continued to design projects using iron railway viaducts with supports of iron, and a bridge over the Douro River in Portugal. He decided to open his own factory just outside Paris in the town of Levallois-Perret. This combination of artistry, experience with iron, his own manufacturing and production facilities, and extensive business management experience enabled Eiffel to be one of the first macro-engineers to complete his great work not only within the prescribed budget but ahead of the estimated schedule.

While France was the nexus of great engineering works, it may have been Eiffel's experiences in the United States that sparked his the idea for the tower. In 1876, he saw a proposal by two Americans, Samuel Fessenden Clarke and Arthur M. Reeves, who had designed a circular iron-framed tower intended as an engineering monument and icon for the Centennial Exposition of 1876. Clarke and Reeves' design was included in the 100<sup>th</sup> anniversary of the American Revolution—a fact that may have influenced Eiffel as he considered a piece for the 100<sup>th</sup> anniversary of the French Revolution. Eiffel himself credited Clarke and Reeves as the source of his inspiration.

Eiffel's design took advantage of new materials with which architects and engineers were beginning to become familiar. Before this time, *Les Grands Travaux* were large in the sense of wide and long, and often based on stone construction—canals, aqueducts, bridges; they were not especially high, except of course for the famous medieval cathedrals. Eiffel's monument is a marvel of physics. He was a pioneer in the aerodynamics of high frames, using a mathematical formula to determine the exact curve of the structure's base that would withstand the force of the wind against it and transform that force into added structural support. It is noteworthy that the Eiffel Tower sways only 4.5 inches at the top. The exact math of Eiffel's discoveries can be found in his 1913 work, *The Resistance of the Air*. Eiffel's physics paved the way for the modern skyscrapers erected in recent years.

The tower's height is an important factor in its endurance. Although the contract set twenty years as the length of time the tower would remain in the Parisian park, the Champs de Mars, when the contract expired, the tower's height made it the obvious choice for siting communication antennae. So it remained in the park—to send telegraph signals.

Eiffel saw the advantages of adding communication antennae to the tower. When the first radio signals were sent by Eugène Ducretet in 1898, it was Gustave Eiffel who approached the military in 1901 and suggested that the tower be incorporated into an infrastructure for long-distance radio communications. By 1903, radio signaling had made major progress, and the military was sending messages from the tower to bases around Paris, and by 1904 to the French east coast. A permanent radio station was installed in the tower in 1906. In 1910, its antenna became part of the International Time Service. Ever an enthusiast for the modern and new, Eiffel was gratified when the first European public radio broadcast came from the tower in 1921, just two years before his death. It would have pleased Eiffel that in 1957 television signals were added; no doubt he would approve of the web cam that today allows people from all over the world to see vistas from the Eiffel Tower via the Internet.

#### PLANNING

The Eiffel Tower was perhaps more carefully and meticulously planned than any macro project in history—and all the planning was done by Eiffel himself. In fact, planning may have taken longer than building. As a result of such fastidious preparation, the project was finished ahead of schedule. In just two years, two months, and five days, Eiffel and his team successfully accomplished this engineering feat with such perfection that the individual pieces were tooled to an accuracy of one-tenth of a millimeter.

It took tremendous planning to foresee that most of the parts would have to be forged, machined, and assembled off-site and then installed. Workers at Eiffel's factory at Levallois-Perret made the parts; many had previous experience working on Eiffel's viaducts.

The on-site work crews required special organization. Teams of four men were needed to install each rivet: one held the rivet in place, one heated it red-hot, a third made sure the head of the rivet was positioned exactly right, the fourth hammered it into place. Eiffel had planned the process with such precision that the hot rivets could cool right in place, expand as they cooled, and thereby strengthen the structure by taking advantage of natural thermodynamic principles.

The Eiffel Tower was one of the most meticulously planned and bestmanaged macro construction projects in history.

## BUILDING

The tower was constructed of iron and held together by 2.5 million rivets, all resting on a masonry base. The foundation was made of caissons filled with concrete and sunk into the ground; these were 50 feet long, 22 feet wide, and 7 feet deep. The tower consisted of two platforms and a laboratory at 896 feet for Eiffel's use. All sections of the tower were prefabricated; seven million holes were drilled off-site, and remarkably there were no significant difficulties with on-site assembly.



The precision of the planning shows up in the contract presented here. For instance, one curious but highly specific detail is the reference in Article 2: "Widow Bourouet-Aubertot, owner of the hotel on the avenue de la Bourdonnaye, 10." The widow had approached the Prefect of the Seine threatening to require demolition of the Eiffel Tower, which was in the midst of construction. The contract states: "The aforementioned widow has withdrawn a provisional execution of a judgment to intervene." That settled the matter, and in the process made the Widow Bourouet-Aubertot forever famous or infamous. Her story is just one of many complaints from abutters, interested parties, affected parties, and others whose viewpoints Eiffel had to confront.

Article 3 of the contract is noteworthy for more substantive reasons. It addresses park landscaping, which would be disturbed by the tower construction. The contract stipulates that Eiffel will be responsible for any plantings moved, and "will support the costs of removal by the gardeners of the city the trees, bushes, and plants that must be displaced." Note that the city's gardeners would do the work, not a work crew of riveters.

Another concern in Article 3 was: "Mr. Eiffel will not cause any changes to the hydrants, sewer drains, or water pipes situated in the Garden of the city." Here we learn of the exquisite city planning for Paris, which located a water source under the park. There are two advantages to such a placement. First, the water pipes could be used to assist in irrigation of the plantings. Second, the pipes are located beneath a surface that is subject to little vibration except running children; hence there would be few disturbances to the critical infrastructure of the Parisian water system. Gardeners and students of Indian architecture might recall that the Taj Mahal used a similar design, locating water pipes under the gardens.

Les Egouts (the sewers) of Paris remain a tourist highlight, with an entrance beneath one of the bridges crossing the Seine. The sewer was designed during the administration of Haussmann, Napoleon III's famous Prefect of the Seine. Paris had been one of the unhealthiest cities in the world, assailed by repeated epidemics. Haussman insisted on cutting wide avenues that provided fresh air, thereby opening up narrow streets that had remained unchanged since medieval times.

Another portion of the contract presented here provides specific guidelines for the use of the Eiffel Tower in case of war. In Article 8, Eiffel is instructed: "In order to facilitate scientific or military purposes or use, Mr. Eiffel will reserve on each floor a special room which will remain free for the disposition of persons designated by the Minister of the General Commission." In a note of finesse, it is added that said Minister will get 300 free admissions per month and the admissions can use the elevators. Article 13 requires that in times of war or a state of siege, the government will have the right to use the tower, perhaps for its vantage point as a lookout, but more likely for sending signals. The contract is meticulous in outlining how Eiffel will be repaid for time lost during military use, and provides that "the term of concession will be extended one year for every period of three months or fraction of three months during which the suspension occurs."

A discussion of the construction of the Eiffel Tower is not complete without consideration of the elevators. Never before had *ascenseurs* risen to such heights. The French company Roux, Combaluzier and Lepape built the first elevators, which carried passenger to the first platform by means of hydraulics, utilizing a double-looped chain for extra safety. In 1897, those elevators were replaced by equipment from the French firm Fives-Lille; these lasted 90 years until they were improved in 1987. But even the Fives-Lille company only had the technical know-how to bring the elevators to the first level.

How could visitors get further without climbing the endless stairs upward? This was a task for the world's best-known elevator man, Elisha Graves Otis. In 1853, Otis introduced the world's first safety elevator in Yonkers, New York. From that point on, buildings could rise beyond the limitations of stairs. In one of his greatest works, Otis designed elevator cabins as two-decked rooms mounted on sloping runners and pulled by a cable that was powered by a hydraulic piston.

The *piece de résistance* was the vertical lift designed by Leon Edoux to bring visitors to the top of the tower. Passengers changed cars halfway up, as only one car could continue upward, counterbalanced by the other going down, in a design not unlike a water clock and similarly powered by water tanks that helped provide the hydraulics. Of course, Edoux's ingenious engineering did not work in the winter when frozen water in the tanks made operations impossible until the spring thaw. Edoux's marvelous invention operated until 1983 when technology had advanced sufficiently to offer a replacement.

At his own risk—and his own profit—Eiffel was free to conduct the construction in any manner he chose. He also was given the right to fix the fee for admission to the tower: higher on weekdays than on weekends. In return for these allowances, and for the right to lease and collect rents from the shops and cafés associated with the tower, Eiffel was required to pay 1,000 francs to the Exposition Commission. Eiffel was also legally bound to pay the City of Paris for rental of the land on which the tower was built—a nominal 100 francs per annum (Article 12).

The contract for building the Eiffel Tower contains insurance provisions, a feature lacking in many other contracts of similar vintage. Eiffel was required to put aside one percent to cover potential expenses for sick or wounded workers. In addition, Eiffel was bound to set aside a reserve fund to deal with accidents. *It should be noted that there were no fatalities during the course of the construction*—a tribute to Eiffel's well-orchestrated planning. The one recorded death of a workman occurred off site and off duty.

Like his fellow engineer/entrepreneur, John Roebling, who built the Brooklyn Bridge in the United States using steel ropes manufactured in his own factory in New Jersey, Gustave Eiffel built the Eiffel Tower six years later utilizing a similar management process: coordination of on-site work with ongoing construction being prepared in his own nearby factory. Both of these mechanical engineers were not just designers but also business owners and managers—Eiffel was Mr. Iron, and Roebling was Mr. Steel. Both built structures higher than had ever been done before.

The tower bears the names of 72 of France's greatest technical minds, 18 luminaries on each of the four sides of the base. For most French people, however, one name is mentioned even more frequently than Eiffel's: Monsieur Poubelle, the Prefect of the Seine, who signed the contract featured here on behalf of the government. M. Poubelle is the inventor of the garbage pail, which is still used all over Paris and France. The ubiquitous receptacle is actually called a poubelle.

# **IMPORTANCE IN HISTORY**

What distinguishes the Eiffel Tower is not just its beauty or symbolism. Like the Colossus of Rhodes, it was a technological marvel of its time, pushing the limits of existing engineering knowledge. It is a little known fact that Eiffel helped build the Statue of Liberty in New York harbor. In 1885, he worked with Frederic Bartholdi to create the wrought-iron pylon inside the statue.

Eiffel was duly recognized for his tremendous achievement. On the 200 franc banknote (the currency of France before the adoption of the euro in 2002), there was a depiction of Gustave Eiffel and on the reverse side, the Tower. It is a distinction afforded few engineering projects, and a sign of his place in French history. Even in France today, the top of the social hierarchy is not, as some might imagine, painters, designers, or aristocrats, but instead it is engineers.

While standing at the top of his completed monument, Gustave Eiffel proudly received the Legion of Honor, inducting him into that elevated society that has given special distinction and national renown to France.

The Eiffel Tower has made such an impression on the world that it was especially honored in Shanghai, China in a cultural exchange featuring the Oriental Pearl TV Tower, built for telecommunications, and one of the world's highest buildings (468 meters or 1535 feet).

Eiffel continues the tradition of *Les Grands Travaux* as a worthy successor to Pierre-Paul Riquet (the Canal des Duex Mer), Ferdinand de Lesseps (the Suez Canal), French-born Isambard Kingdom Brunel (the RMS *Great Eastern* and the Thames Tunnel), and more recently Louis Armand (modernizer of the French railways).

## FOR FURTHER INFORMATION

#### Books

Clark, Ronald W. Works of Man. New York: Viking: 1985.

Fletcher, Sir Banister. *Sir Banister Fletcher's A History of Architecture*. Revised by J.C. Palmer. New York: Charles Scribner's & Sons, 1975.

Harris. S. *The Tallest Tower: Eiffel and the Belle Époque*. Washington: Regnery Gateway, 1989. ISBN 0-89526-764-0.

Hawkes, Nigel. *Structures: Man-Made Wonders of the World*. London: Marshall Editions, 1990.

### Internet

For an update on what's new currently in events involving the Eiffel Tower, see: <a href="http://www.tour-eiffel.fr">http://www.tour-eiffel.fr</a> (Accessed 2/05).

For the construction process, especially the rivets and the elevators, see: <<u>http://www.tour-eiffel.fr/teiffel/uk></u>(Accessed 2/05)

For a 3D model of the tower and many images, see: <<u>http://www.greatbuildings.com/buildings/Eiffel\_Tower.htm</u>> (Accessed 11/04)

For Eiffel's advocacy of radio signals from the tower, see: <a href="http://www.tour-eiffel.fr/teiffel">http://www.tour-eiffel.fr/teiffel</a> (Accessed 11/04)

For Eiffel's physics and the use of air to strengthen high building construction, see: <a href="http://www.discoverfrance.net/France/Paris/Monuments-Paris/Eiffel.html">http://www.discoverfrance.net/France/Paris/Monuments-Paris/Eiffel.html</a> (Accessed 2/05)

For a more comprehensive bibliography of Gustave Eiffel and the Tower, featuring books, films and CDs, see: <a href="http://www.tour-eiffel/fr.tieffel/uk">http://www.tour-eiffel/fr.tieffel/uk</a>. (Accessed 2/05)

## Video

Perkins, Jack. "Modern Marvels: The Eiffel Tower." Modern Marvels, 1994. VHS ISBN 63034 20 699.

# **Document of Authorization**

# **Agreement Concerning the Eiffel Tower**

Paris, Imprimerie et Librairie Centrales Des Chemins De Fer, Imprimerie Chaix, Société Anonyme au Capital de Six Millions, Rue Bergèree, 20, 1889.

Agreement Concerning the Eiffel Tower

Between Mr. Edouard LOCKROY, Minister of Commerce and Industry, Commissioner General of the Universal Exposition of 1889, acting in the name of the State;

Mr. Eugène POUBELLE, Prefect of the Seine, acting in the name of the City of Paris, thus here is that which was authorized by the Municipal Council during deliberations from the 22 of October to the 28 of December 1886 and that which is fixed and limited by the deliberations, which remain enclosed as exhibited here:

As one party;

And Mr. EIFFEL, Engineer-Constructor, living in Leval-lois-Perret, rue Fouquet, number 42; acting under his own personal name;

As the other party.

These parties have made the following agreements.

## Article 1

Mr. Eiffel promises to the Minister of Commerce and Industry, The Commissioner General of the Universal Exposition of 1889, to construct, in the role of entrepreneur, in the enclosure of the Exposition, in the Champ de Mars, a Tower made of iron of the height of 300 meters as part of the construction of the Exposition, for which the plans and estimate are here attached to the present agreement.

This Tower will be completed and put into use by the opening of the Exposition of 1889.

# Article 2

The Tower will be erected in one part of the Champ de Mars, placed according to the disposition of the minister of Commerce and Industry by the City of Paris, as has resulted from the deliberations of the Municipal Council of the City of Paris during the dates from October 22 to December 28 1886.

It will occupy the site indicated in the plan here attached, seen in the deliberations of the Municipal Council.

It is explained here, for purposes of clarification, according to the terms of the agreement dated in Paris on the 28 of December 1880, registered, handed over by the State to the City of Paris that a Park for the Exposition will be established in the Champ de Mars (next to the Seine) so that it can now proceed and be required, by the authority of the City of Paris, to complete and finalize the aforesaid Park and maintaining it in good condition with this stipulation:

"In the case where the Universal Exposition will take place in the Champ de Mars, the free use of the park will be assured by the State, with the responsibility of restoring it to good condition after the Exposition.

"And the City may transfer power to the vendors to construct on the frontage of the two avenues of Suffren and of La Bourdonnaye, two zones of 40 meters each in breadth, including the areas reaching up to the avenues to the Park."

It is agreed that the ground plot, already having been allocated into several lots, will be awarded to various vendors, following the official proceedings of diverse dates; and that the aforesaid proceedings, under the rubric: Origin of Rights of Ownership, recalling the outcomes of the agreement of the 28 of December 1880 between the State and the City of Paris; which, under the rubric: Terms and Conditions, is stated in article 5:

## "Legal Rights and Methods of Access.

"Each proprietor will have the right of egress to the Park in the Champ de Mars through the means of a grill gate cross-barred and set within the gate (*Editor's Note*: such as in a convent, e.g., a gate within a gate); this will be established during the Exposition in the Champ de Mars, and the right of egress will be suspended and the grillgate will be closed in some manner during the Exposition.

"The successful bidders for the area around the façade of Avenue A and Avenue B will have the rights of opening and exiting through the pathways."

It is further agreed that the enunciations and stipulations which preceded are being restated: two of the claimants to property have maintained that the establishment of the Eiffel Tower in the Park of the Champ de Mars was contrary to their legal rights that had already been consented to by the City of Paris.

That one of these, the Widow Bourouet-Aubertot, owner of the hotel on the avenue de La Bourdonnaye, 10, has herself addressed to the Prefect of the Seine, on the 6 of November 1886, a previous memo concerning a suit which she intended to introduce before the Civil Tribunal of the Seine, for the purpose of forbidding the City of Paris to act or to allow the establishing of the Eiffel Tower in the Park of the Champ de Mars and to require the demolition of all the work which had begun in contempt of the suit. The aforementioned widow has withdrawn a provisional execution of a judgment to intervene.

That the City of Paris may not mortgage the Park in the Champ de Mars for profit through real estate sales, but has the legal right to exercise the power being impeded or hindered by the establishment of the Eiffel Tower, and that the vendors are without legal rights, either to oppose this establishment or to claim legal damages.

This having been said, Mr. Eiffel promises to do his utmost to support the damages which could result from the construction and the exploitation of the Tower, without the power to invoke any of the previous cases or provisions here in the guaranty of the City or of the State.

# Article 3

Mr. Eiffel may not occupy temporarily any part of the Garden of the city. except for the placement of the Tower, without the authorization of the Prefect of the Seine. He will support the costs of removal, by the gardeners of the city, the trees, bushes, and plants that must be displaced. He will furthermore be responsible for all the damage that may result to the garden during the construction of the Tower, and for these he will reimburse the City.

Mr. Eiffel will not cause any changes in the hydrants, sewer drains, or water pipes situated in the Garden of the city, without the prior authorization of the

# Article 4

The enterprise will be comprised of the foundation of the basement, the substructure of masonry, the complete metal framework, the construction and interior equipment for all the rooms and floors, as well as all the lightening rods and their accessories; but it will not include the fitting out of the grounds around the perimeter of the Tower, nor the transformation of the avenues, squares, and other fixtures as per the wish of the Director of the Exposition, which in no case will be the responsibility of Mr. Eiffel.

# Article 5

The Tower will be constructed in conformity with the preliminary plan which was submitted to the Special Commission named by the Minister of Commerce and Industry by order of the date of the 12 of May 1886, modified in the estimate and the design sketches here attached following the conclusions of the report of that Commission. The project will moreover be completed with regard to the electrical works in conformity to the conclusions in the report of that Commission dated the 24 of June 1886, which is attached to the present document.

# Article 6

Pursuant to these conditions, Mr. Eiffel will be responsible for the definitive plans and the complete execution of the Tower, which will be under his responsibility. He will present the project in the execution of the foundation, which will be submitted for examination to the Commission specially instituted by the order of the 12 of May 1886. The project thus is ordered to be put into execution, with the modifications that are judged necessary through common accord in the course of execution. Mr. Eiffel will remain, during the execution of the work, under the direction of the Engineers of the Exposition and the Controller of the Commission specially instituted on the 12 of May 1886.

Mr. Eiffel is required to obtain approval for all the project details and especially the elevators that will be employed in the interior of the Tower, and he may undertake the establishment of the elevators only after the approval of the Minister of the General Commission.

The Tower may not be put into use until after it has been approved and accepted by the special Commission, even if the acceptance requires some

amendments, whatever they may be, and these will be the responsibility of the constructor. It is understood that the modifications or rework recognized as necessary by the special Commission will not give rise to any additional expenses that will be the responsibility of the Exposition.

# Article 7

For the price of the work, such as is evaluated in the estimate here-attached, it is agreed that the payment to Mr. Eiffel the sum of 1,500,000 Francs for the credits allowed by the Exposition, and the enjoyment and dividends resulting from the exploitation of the Tower during the year of the Exposition and during the twenty years that follow, from the date of the first of January of eighteen hundred and ninety, during the whole of which time the following conditions must be followed:

The sum of 1,500,000 Francs will be paid out as follows:

Firstly, 500,000 (five hundred thousand) Francs when the metal framework has reached the height of the floor of the first stage;

500,000 (five hundred thousand) Francs when the metal framework has reached the second stage;

500,000 (five hundred thousand) Francs when the work is complete and has been provisionally received and accepted for exploitation and use;

Secondly, during the total duration of the Exposition, Mr. Eiffel will exploit to his own profit and at his own risk and peril the aforesaid construction in a manner that will be judged as best conforming to his own interests, as much as can be gained from the elevators for the public and from the installation of restaurants, cafes, etc.

He will remain the master for the fixing of tariffs to be applied without exceeding the maximums indicated as follows:

Elevators to the top:	Weekdays: Sundays and holidays:	Fr. 5 Fr. 2
Elevators to the first stage:	Weekdays: Sundays and holidays:	Fr. 2 Fr. 1

These numbers, which are applicable to the elevators effective between the hours of 11am and 6pm, may be modified at the request of Mr. Eiffel if experience demonstrates the necessity, and if the Minister of the General

Commission judges necessary. In all cases, as concerns the cafés, restaurants, and other related establishments in the construction of the Tower, the concessions made to these third parties by Mr. Eiffel must be approved by the Minister and must follow the rules applied to establishments of this nature in the rest of the Exposition.

Mr. Eiffel will be responsible to the State or to the City for the third parties which may be thus substituted. In any case the aforesaid substitutes will not have any legal right or redress, for any cause whatever it may be, against the State and the City, and the enjoyment and use of their concession will be subordinated during the duration of the exploitation to Mr. Eiffel himself or to the Society afterward provided. Mr. Eiffel will give these rightful claimants or their substitutes full knowledge of the present agreements and take full responsibility for the communication of said agreements.

Mr. Eiffel will, therefore, pay to the Administration of the Exposition, a sum of 1,000 (one thousand) Francs for the right of establishing the beneficial rents during the duration of the Exposition.

## Article 8

In order to facilitate scientific or military purposes and use, Mr. Eiffel will reserve on each floor a special room, which will remain free for the disposition of persons designated by the Minister of the General Commission.

In addition, Mr. Eiffel will give to the disposition of the Minister of the General Commission, for the same purpose, a number of free admissions, which will not exceed 300 (three hundred) per month. These admissions will be given the free right of passage in the elevators or the stairs.

## Article 9

The Administration of the Exposition will dispose, for such rightful usage as it wishes, all of the land surrounding the Tower which is not occupied by the four base columns which support it. The Administration will, in all cases, hold in reserve, all around these base column supports, the means of access necessary for the public to arrive easily at the elevators, the stairs, and any other parts of the Tower and for provisions of any and all nature, necessary for the use of these, for entry.

# Article 10

During the whole duration of the Exposition, Mr. Eiffel will have free admission to the Exposition for himself and for the personnel who are involved in the maintenance and service of the Tower.

# Article 11

After the Exposition and the replacement of the Park in the Champ de Mars, the City will then become the owner and proprietor of the Tower, with all the advantages and obligations relevant to this; but Mr. Eiffel in the completion of the fee for the work, will retain the enjoyment until the expiration of twenty years from the date of 1 January 1890, at which point this enjoyment and use shall return to the City of Paris. After these twenty year, the return of the Tower will be made in good condition of maintenance, and during that twenty years' time it will be required of Mr. Eiffel to make any special, required repairs.

# Article 12

During the whole of his period of exploitation, Mr. Eiffel will remain in all regards concerning this exploitation responsible for the same conditions that will apply during the Exposition, except that he will pay to the City of Paris a consideration of 100 (one hundred) Francs per year beginning on 1 January 1890 for the land occupied by the Tower and that which is necessary for its exploitation and also that which the City may substitute for the Minister of the General Commission, for the enjoyment of floors especially fitted out for scientific experiments.

It is intended that the City of Paris will always maintain in the Tower an access in keeping with the needs of exploitation, notably access by elevator car.

# Article 13

In the case of war or the declaration of a state of siege, the State will have the clear right to take the place, actively or passively, of Mr. Eiffel for the use of the Tower. An appraisal will be made of the value of the installations, and each side will have the right of comparison and of agreement with said value.

During the entire time Mr. Eiffel is thus deprived of the use of the Tower, the State will be completely responsible.

For compensation of this suspension of use, the term of the concession will be extended one year for every period of three months or fraction of three months during which the suspension occurs.

# Article 14

Mr. Eiffel will, at every moment, have the legal right to form an Association or Company either for the construction, or for the exploitation, of the Tower, which Association or Company will cede back all or part of its rights and obligations. The said substitution will be approved by the State or the City, following the period of exploitation in which the Association will be constituted.

# Article 15

In the case where, after the advice of the Commission specially instituted by decree of the Minister, on the date of 12 May 1886, Mr. Eiffel or his rightful claimants, will not perform due diligence necessary to assure the completed execution for the engagements of the date of the opening of the Exposition, also in the case of Mr. Eiffel or his rightful claimants does not manifest the wish to continue the work, or the wish can be implied as such by the cessation of the work for a period of twenty days in which the work is stopped and remains ineffective, the State has the right to cancel the present agreements and to continue the execution of work as is here decreed:

<u>First</u>. In the case of cancellation, the State may leave the work in the situation in which they found it; in this case, Mr. Eiffel will be owed, from the original allocation of 1,500,000 Francs, a sum proportionate to the completed work.

The State can also demolish the construction completed to date. In this case, the net proceeds of the resale of the materials (after the deduction of the cost of demolition and the return of the place to its former state) will revert to Mr. Eiffel or his rightful claimants, for all that exceeds the portion of the sum of 1,500,000 Francs already given to Mr. Eiffel or to his rightful claimants.

<u>Second</u>. In the case where the State opts to continue the work, they will carry out the administration, by the means which the State might judge necessary, at the expense of Mr. Eiffel, whose help and surveillance that may be necessary obtained by entrepreneurs chosen by the State, the ensuing Contract resulting will be in effect for the rest of the disposition.

# Article 16

As a guaranty for the engagement undertaken by him, Mr. Eiffel will deposit, according to a deadline that will be fixed by the Ministry, as a bond of surety, the sum of 100,000 (one hundred thousand) Francs in legal deposits, for yearly income to the State registered or mixed, or rent to the State and value to the Treasury, to the bearer, conforming to Articles 5 and following of the decree of 18 November 1882.

This sum will be returned to Mr. Eiffel after the completion of the achievement and the definite acceptance of the Tower, except for 10,000 (ten thousand) Francs which will be retained until the expiration of the present agreement.

# Article 17

The parties will remain compliant to the clauses and conditions general and relative to the enterprises of the Exposition, decreed by the Minister of the General Commission on 5 August 1886, in all those aforesaid clauses which are not contrary to the present agreement.

In all times, as concerns Article 17 relative to the safety of workers who may be sick or wounded, it is intended that a reserve of one percent will be apportioned from the allocation of 1,500,000 francs granted by the state.

It is further intended that the relief allowed by the Administration of the Exposition, by virtue of the dispositions here recalled, will be the responsibility of Mr. Eiffel for accidents of every nature which shall exceed the reserve of 15,000 (fifteen thousand) Francs.

# Article 18

The present agreement will only be legal when accompanied by a prescribed registration fee of three (3) Francs.

The present agreements are done in triplicate originals in Paris, the 8 of January, 1887.

Seen and approved: Signed: E. LOCKROY Seen and approved: Signed: G. EIFFEL

Seen and approved: Signed: POUBELLE