ACING IT: HOW MAFFEIS COVERED PARIS'S MOST FAMOUS TENNIS COURT

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Maffeis Engineering is proud to be the main designer for the new roof of the iconic Roland Garros.

Think of the great tennis courts, and the red clay of the French Open springs to mind. The iconic tournament, commonly known as Roland Garros, has been the stage of tennis's most memorable dramas.

Today, the French Open holds an undeniable glamour. It is the only significant professional tennis tournament that lasts 15 days, always beginning on a Sunday. The tournament is still played on clay courts, a retro and aesthetically pleasant alternative to newer hard courts. In addition, the stunning location of the Roland Garros Stadium in Paris allows tennis spectators to view the Eiffel Tower across the top of the main stadium.

But even the greatest structures need to be renewed and modernized. Recently, the French Tennis Federation decided to modernize the historic tennis stadium, built in 1928, through an ambitious, innovative and sustainable refurbishment.

1 Philippe-Chatrier court in current configuration

The Federation called on famed landscape designer Michel Corajoud to redesign the stadium's landscaping, opening up the stadium to its surrounding environment in Porte d'Auteuil (Figure 2; Figure 3). However, the most ambitious renovation is to be the main court, the renowned Philippe-Chatrier Court, a job with which Maffeis has been entrusted.

A new roof for the Philippe-Chatrier Court

Unlike most of its international counterparts, Roland Garros Stadium is not currently covered by a roof.
A retractable roof was chosen to retain the Philippe-Chatrier Court's identity as a magnificent open-air court bathed in natural light and sunshine. The retractable roof can be closed in less than a quarter of an hour and will enable play on the court to continue during adverse weather or nightfall, as well as evening sessions.

Maffeis was designated as the main designer of the steel structures of roof and stands, mechanical movement roof system, fabric roof and installation methodology, and of this outstanding project in joint venture with Cimolai Spa an Italian steel construction company and VINCI Construction the French general contractor firm.

The roof project will consist of 11 beams supported over a 102-m long span. The beams will have a fully welded 3-m height double T section, with a lateral box section providing torsional stiffness. The quality of the steel will be S460, and the thicknesses of the flanges will vary between 25 and 60 mm. The thickness of the webs will be 15 mm.

2 Scenic view of the Court Philippe-Chatrier with the new retractable roof and the surrounding area
3 Rendering of the new retractable roof, Court Philippe-Chatrier
4 Outside view of the new roof in deployed configuration

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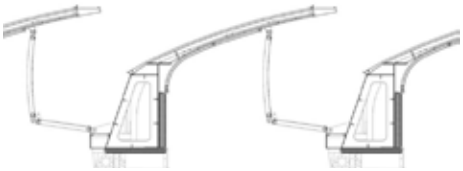

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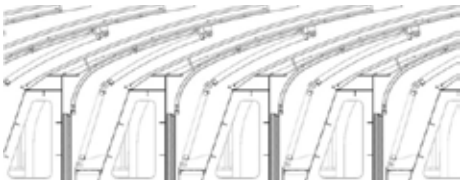

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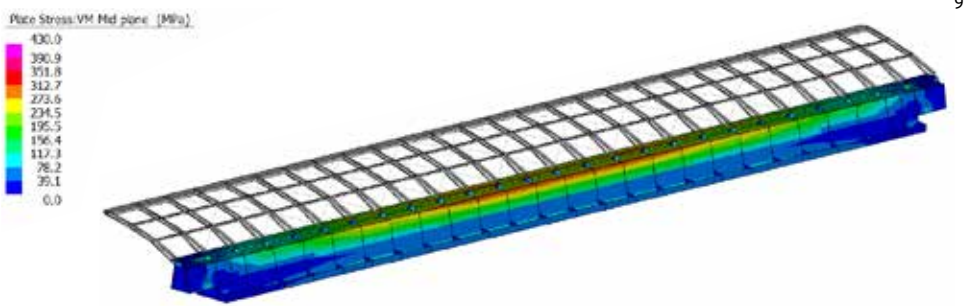
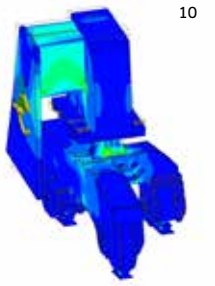


The 11 beams will spread over an area of almost 1 ha in their deployed configuration. This large area is made possible by the use of modern ultra-light fabric materials that incorporate wing-like cantilevers, and an articulated and foldable compass-like system between adjoining beams. The operation of such a retractable roof is achieved by a custom-designed rack-roller, a truly multi-disciplinary challenge involving both advanced civil and mechanical engineering skills.



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To ensure the movement of the roofing fabric along the sliding direction of the roof, a mechanical traction system driven by a pair of gear-motors with two pinions (one for each motor) was selected for each roller. An electronic differential control system (master-slave) allows the control system to maintain constant and equal traction. In the case of failure of one of the two motion groups, the pinion can be released and the roller can move at reduced speed.

The design of the retractable roof was made more difficult by considering wind-induced dynamic forces. Accounting for these important dynamic forces required extensive numerical investigation and wind tunnel testing of scaled samples under the supervision of Maffeis Engineering.

5 Inside view of the Court with the roof in folded configuration
6 Inside view of the Court with the roof in deployed configuration
7 Box-beams opened configuration
8 Box-beams closed configuration
9 3-D FE models of the box-beams
10 FEM ananlysis of the roller-mechanism

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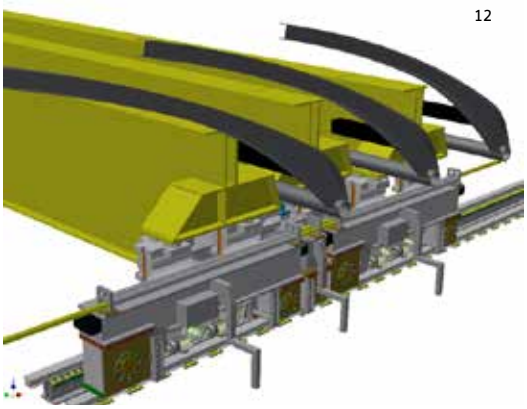

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Underneath the retractable roof, the 15,000-seat stadium will also be redesigned with new, more comfortable stands and new spectator areas providing more comfort and creating extra space for all participants involved in the tournament. The expanded space is made possible by a new steel skeleton consisting of 3000 tons of spectator stands along the perimeter of the stadium. The steel skeleton's design must account for the heavy loads transferred by the retractable roof onto the perimeter and for comfort criteria related to mitigation of vibration-induced forces caused by spectator movements.

For Maffeis Engineering, the Roland Garros Stadium presents a wonderful opportunity to introduce innovative design, new research and sustainability expertise to the definition of new standards for new sports arena structures.

11 Section view of the Philippe-Chatrier court
12 Rendering view of the roller-mechanism
13 Render view roof -1
14 Render view roof -2
15 Render view of the box-beam and wing