The Millau Viaduct (French: le Viaduc de Millau, IPA: [vjadyk də mijo]) is a cable-stayed bridge that spans the gorge valley of the River Tarn near Millau in southern France. It is the tallest bridge in the world, with one mast's summit at 343.0 metres (1,125.3 ft) above the base of the structure. In a Franco-British partnership, it was designed by the English architect Sir Norman Foster and French structural engineer Michel Virlogeux, and as of May 2017 it is the twenty-second highest bridge deck in the world, being 270 metres (890 ft) between the road deck and the ground below.

The Millau Viaduct is part of the A75-A71 autoroute axis from Paris to Béziers and Montpellier. The cost of construction was approximately € 394 million. It was built over three years, formally inaugurated on 14 December 2004, and opened to traffic two days later on 16 December. The bridge has been consistently ranked as one of the great engineering achievements of all time, and received the 2006 Outstanding Structure Award from the International Association for Bridge and Structural Engineering.

**History**

In the 1980s, high levels of road traffic near Millau in the Tarn valley were causing congestion, especially in the summer due to holiday traffic on the route from Paris to Spain. A method of bypassing Millau had long been considered, not only to ease the flow and reduce journey times for long distance traffic, but also to improve the quality of access to Millau for its local businesses and residents. One of the solutions considered was the construction of a road bridge to span the river and gorge valley. The first plans for a bridge were discussed in 1987 by CETE, and by October 1991 the decision was made to build a high crossing of the River Tarn by a structure of around 2,500 metres (8,200 ft) in length. During 1993–1994, the government consulted with seven architects and eight structural engineers. During 1995–1996, a second definition study was made by five associated architect groups and structural engineers. In January 1995, the government issued a declaration of public interest to solicit design approaches for a competition.

In July 1996 the jury decided in favour of a cable-stayed design with multiple spans, as proposed by the Sogelerg consortium led by Michel Virlogeux and Norman Foster. The decision to proceed by grant of contract was made in May 1998; then in June 2000, the contest for the construction contract was launched, open to four consortia. In March 2001, Eiffage established the subsidiary Compagnie Eiffage du Viaduc de Millau (CEVM), and was declared winner of the contest and awarded the prime contract in August.

**Possible routes**

[](https://en.wikipedia.org/wiki/File:Projets_A75_autour_de_Millau.jpg)

The four proposed routes for the new [A75 autoroute](https://en.wikipedia.org/wiki/A75_autoroute) around [Millau](https://en.wikipedia.org/wiki/Millau)

In initial studies, four potential options were examined:[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

1. **Great Eastern** (*grand Est*) ( yellow route ) — passing east of [Millau](https://en.wikipedia.org/wiki/Millau) and crossing the valleys of the [Tarn](https://en.wikipedia.org/wiki/Tarn_(river)) and [Dourbie](https://en.wikipedia.org/wiki/Dourbie) on two very high and long bridges (spans of 800 and 1,000 [metres](https://en.wikipedia.org/wiki/Metre) or 2,600 and 3,300 [feet](https://en.wikipedia.org/wiki/Foot_(unit))) whose construction was acknowledged to be problematic.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] This option would have allowed access to Millau only from the [Larzac](https://en.wikipedia.org/wiki/Larzac) plateau, using the long and tortuous descent from [La Cavalerie](https://en.wikipedia.org/wiki/La_Cavalerie). Although this option was shorter and better suited to through traffic, it did not satisfactorily serve the needs of Millau and its area.
2. **Great Western** (*grand Ouest*) ( black route ) — longer than the eastern option by 12 [kilometres](https://en.wikipedia.org/wiki/Kilometre) (7.5 [mi](https://en.wikipedia.org/wiki/Mile)), following the [Cernon valley](https://en.wikipedia.org/w/index.php?title=Cernon_valley&action=edit&redlink=1). Technically easier (requiring four viaducts), this solution was judged to have negative impacts on the environment, in particular on the picturesque villages of [Peyre](https://en.wikipedia.org/wiki/Peyre,_Aveyron) and Saint-Georges-de-Luzençon.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] It was more expensive than the preceding option, and served the region badly.
3. **Near RN9** (*proche de la RN9*) ( red route ) — would have served the town of Millau well, but presented technical difficulties,[[*clarification needed*](https://en.wikipedia.org/wiki/Wikipedia:Please_clarify)] and would have had a strong impact on existing or planned structures.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]
4. **Intermediate** (*médiane*), west of Millau ( blue route ) — was supported by local opinion, but presented geological difficulties, notably on the question of crossing the valley of the [River Tarn](https://en.wikipedia.org/wiki/Tarn_(river)). Expert investigation concluded that these obstacles were not insurmountable.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

The fourth option was selected by [ministerial decree](https://en.wikipedia.org/wiki/Ministerial_decree) on 28 June 1989. It encompassed two possibilities:

1. the high solution, envisaging a 2,500-metre-long (8,200 ft) viaduct more than 200 metres (660 ft) above the river;
2. the low solution, descending into the valley and crossing the river on a 200-metre-long (660 ft) bridge, then a viaduct of 2,300 metres (7,500 ft), extended by a tunnel on the [Larzac](https://en.wikipedia.org/wiki/Larzac) side.

After long construction studies by the Ministry of Public Works, the low solution was abandoned because it would have intersected the [water table](https://en.wikipedia.org/wiki/Water_table), had a negative impact on the town, cost more, and lengthened the driving distance. The choice of the 'high' solution was decided by ministerial decree on 29 October 1991.[[15]](https://en.wikipedia.org/wiki/Millau_Viaduct#cite_note-autogenerated4-15)

After the choice of the high viaduct, five teams of [architects](https://en.wikipedia.org/wiki/Architect) and [researchers](https://en.wikipedia.org/wiki/Researcher) worked on a technical solution. The concept and design for the bridge was devised by French [designer](https://en.wikipedia.org/wiki/Design) and structural engineer [Dr Michel Virlogeux](https://en.wikipedia.org/wiki/Michel_Virlogeux). He worked with the [Dutch](https://en.wikipedia.org/wiki/Netherlands) engineering firm [ARCADIS](https://en.wikipedia.org/wiki/Arcadis_NV), responsible for the [structural engineering](https://en.wikipedia.org/wiki/Structural_engineering) of the bridge.

**Construction**

Two weeks after the laying of the first stone on December 14, 2001, the workers started digging the deep shafts. There were four shafts per pylon; 15 metres (49 ft) deep and 5 metres (16 ft) in diameter, assuring the stability of the pylons. At the bottom of each pylon, a tread of 3–5 metres (10–16 ft) in thickness was installed to reinforce the effect of the deep shafts. The 2,000 cubic metres (2,600 cu yd) of concrete necessary for the treads was poured at the same time.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

In March 2002, the pylons emerged from the ground. The speed of construction then rapidly increased. Every three days, each pylon increased in height by 4 metres (13 ft). This performance was mainly due to [sliding shuttering](https://en.wikipedia.org/wiki/Climbing_formwork). Thanks to a system of shoe anchorages and fixed rails in the heart of the pylons, a new layer of concrete could be poured every 20 minutes.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

The bridge road deck was constructed on land at the ends of the Viaduct, and rolled lengthwise from one pylon to the next, with eight temporary towers providing additional support. The movement was accomplished by a computer-controlled system of pairs of wedges under the deck; the upper and lower wedges of each pair pointing in opposite directions. These were hydraulically operated, and moved repeatedly in the following sequence: the lower wedge slides under the upper wedge, raising it to the roadway above, and then forcing the upper wedge still higher to lift the roadway. Both wedges move forward together, advancing the roadway a short distance. The lower wedge retracts from under the upper wedge, lowering the roadway and allowing the upper wedge to drop away from the roadway; the lower wedge then moves back all the way to its starting position. There is now a linear distance between the two wedges equal to the distance forward the roadway has just moved. The upper wedge moves backward, placing it further back along the roadway, adjacent to the front tip of the lower wedge and ready to repeat the cycle and advance the roadway by another increment. It worked at 600 millimetres (24 in) per cycle which was roughly four minutes long.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

The mast pieces were driven over the new road deck lying down horizontally. The pieces were joined to form the one complete mast, still lying horizontally. The mast was then tilted upwards, as one piece, at one time in a tricky operation. In this way, each mast was erected on top of the corresponding concrete pylon. The stays connecting the masts and the deck were then installed, and the bridge was tensioned overall, and weight tested. After this, the temporary pylons could be removed.

[](https://en.wikipedia.org/wiki/File:Millau_Viaduct_construction_south.jpg)

The viaduct under construction, seen from the south in early 2004

**Location**

[](https://en.wikipedia.org/wiki/File:Viaduc_de_Millau_1.jpg)

The Millau Viaduct, and the town of [Millau](https://en.wikipedia.org/wiki/Millau) on the right

The Millau Viaduct is located on the territory of the [communes](https://en.wikipedia.org/wiki/Communes_of_France) of [Millau](https://en.wikipedia.org/wiki/Millau) and [Creissels](https://en.wikipedia.org/wiki/Creissels), France, in the [*département*](https://en.wikipedia.org/wiki/Departments_of_France) of [Aveyron](https://en.wikipedia.org/wiki/Aveyron). Before the bridge was constructed, traffic had to descend into the [River Tarn](https://en.wikipedia.org/wiki/Tarn_(river)) valley and pass along the [route nationale](https://en.wikipedia.org/wiki/Route_nationale) [N9](https://en.wikipedia.org/wiki/Route_nationale_9) near the town of Millau, causing heavy congestion at the beginning and end of the July and August [holiday season](https://en.wikipedia.org/wiki/Holiday_season). The bridge now traverses the Tarn valley above its lowest point, linking two [limestone](https://en.wikipedia.org/wiki/Limestone) [plateaus](https://en.wikipedia.org/wiki/Plateaus), the Causse du [Larzac](https://en.wikipedia.org/wiki/Larzac) and the [Causse Rouge](https://en.wikipedia.org/w/index.php?title=Causse_Rouge&action=edit&redlink=1) ([fr](https://fr.wikipedia.org/wiki/Causse_Rouge)), and is inside the perimeter of the [Grands Causses](https://en.wikipedia.org/wiki/Grands_Causses) regional natural park.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

The Millau Viaduct forms the last link of the preexisting [A75](https://en.wikipedia.org/wiki/E11_A75_autoroute) [autoroute](https://en.wikipedia.org/wiki/Autoroutes_of_France)[[4]](https://en.wikipedia.org/wiki/Millau_Viaduct#cite_note-BBC-Nov2003-4) (known as *la Méridienne*), from [Clermont-Ferrand](https://en.wikipedia.org/wiki/Clermont-Ferrand) to [Pézenas](https://en.wikipedia.org/wiki/P%C3%A9zenas) (to be extended to [Béziers](https://en.wikipedia.org/wiki/B%C3%A9ziers) by 2010). The A75, with the A10 and A71, provides a continuous high-speed route south from [Paris](https://en.wikipedia.org/wiki/Paris) through [Clermont-Ferrand](https://en.wikipedia.org/wiki/Clermont-Ferrand) to the [Languedoc](https://en.wikipedia.org/wiki/Languedoc) region, and through to [Spain](https://en.wikipedia.org/wiki/Spain), considerably reducing the cost and time of vehicle traffic travelling along this route. Many tourists heading to southern [France](https://en.wikipedia.org/wiki/France) and [Spain](https://en.wikipedia.org/wiki/Spain) follow this route because it is direct and without [tolls](https://en.wikipedia.org/wiki/Toll_road) for the 340 kilometres (210 mi) between Clermont-Ferrand and Pézenas, except for the bridge itself.[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

The [Eiffage](https://en.wikipedia.org/wiki/Eiffage) group, which constructed the Viaduct,[[4]](https://en.wikipedia.org/wiki/Millau_Viaduct#cite_note-BBC-Nov2003-4) also operates it, under a government contract, which allows the company to collect tolls (*Péage*) for up to 75 years.[[2]](https://en.wikipedia.org/wiki/Millau_Viaduct#cite_note-BBC-Dec2004-2)[[4]](https://en.wikipedia.org/wiki/Millau_Viaduct#cite_note-BBC-Nov2003-4) The [toll bridge](https://en.wikipedia.org/wiki/Toll_bridge) costs [€](https://en.wikipedia.org/wiki/Euro)7.50 for light automobiles (€9.40 during the peak months of July and August).[[21]](https://en.wikipedia.org/wiki/Millau_Viaduct#cite_note-TollRates-21)