

viaduc

ÉDITÉ PAR LA COMPAGNIE EIFFAGE DU VIADUC DE MILLAU

Already 100,000!



Last June, the 100,000th visitor was welcomed to the site of the Millau viaduct. Fifty thousand more will visit between now and the end of August. There is no doubt about it: the summer is going to be busy on the Cazalous viewing area.

Parc des Princes, Pont de Normandie... It is obvious that I shall come back here on a regular basis to see how the viaduct is progressing!"

Sun, heat and blue skies were at the meeting on this June morning, which registered the 100,000th visitor to the site. This strong attraction was unexpected, even if for some time now technological tourism (or industrial tourism) is all the rage. As a consequence, the welcome pavilion and guided visits form part of the services provided by the Compagnie Eiffage du Viaduc de Millau.

"We have created two types of visit", points out Marie Larguier, responsible for the welcome pavilion. Officials and groups are received on workdays, whereas the public is welcomed on weekends and public holidays, in co-operation with the Millau tourist office which handles the reservations. Visitors are driven by minibus to see the different key features of the site".

A visit appreciated by everybody

You can also go whenever you wish without a rendezvous to the Cazalous welcome area. Information panels, an interactive scale model and a film presenting the project give visitors a first impression of the different phases of the construction of the viaduct. guides are there to answer questions and to accompany the visitors out onto the viewing terrace, on the edge of the construction site. The service, which is completely free of charge, can be completed by a visit to the heart of the work site (10 euros for adults, 5 euros for children).

"The viaduct has become a tourist destination per se. Far more than just the public from the Aveyron region", continues Marie Larguier, "we receive people from all over Europe, principally from Great Britain, the Netherlands, Belgium and Germany". Everybody appreciates the quality of the welcome and the information provided by the guides, as is obvious from the pages of the viaduct visitors' book. ■



André Champrosé,
100,000th visitor to the site.

"Spectacular"! For André Champrosé, the viaduct is without doubt the finest construction site he has ever seen. As a retired director of landscape gardening works, it is with an experienced eye that he admires the piers rising between the Larzac and the Causse rouge over there, far to the north. "We made the journey as a family from the Cote d'Or especially to discover this construction site", he tells us. "I am passionately interested by this type of construction:

Profile

Co-ordinator of studies/works A watchmaker's precision

Nothing could be completed on time, if everything was not programmed "to the millimetre"! Planning the manufacture of the metal parts (box-girder sections, steel plating, etc.), organising their transport, guaranteeing deliveries: these are all tasks which often go unnoticed, but which are essential to the efficient operation of the construction site. "With the assistance of an independent Service Company, explains Raphaël Schaeffer, co-ordinator of studies and works at

Eiffel, I am responsible for the planning of the different tasks and the co-ordination with Eiffel's industrial sites at Lauterbourg and Fos-sur-Mer. I also control the organisation of the exceptional road transports". A job that has to allow for the speed of assembly of the different parts on the construction site... but also the available storage space on site. Not too much, nor too little: the theory of "just in time" applied to a world of giants! ■



Concrete

A firework display for a world record



Pier P2 reaches almost 200 m and it is not over!

Less than a year after the first concrete “lift”, pier P2 rises close to 200 metres into the Aveyron sky, thereby beating the former record for the highest pier in the world. A success that rewards the work of all the Eiffage TP teams.

On June 12, 2003, a new world record was set. By reaching 183 metres, pier P2 earned its place in the Guinness Book of Records. Ten months were sufficient to wipe from the slate the former record of 176 metres held by the Kochertal bridge in Germany. It was an event justifiably celebrated by a firework display lasting twenty minutes, partly set off from the top of the pier which is still under construction.

“The first pouring of concrete took place in mid-August last year”, recalls Daniel Guille, in charge of the P2 work site. “Two teams of 10 people worked in shifts without respite day after day to achieve the forty-eight concrete “lifts” which have enabled us to reach the present height. Only sixteen more and we will reach the top”! In October, the pier will be finished and the prestressing cables set in the final double needle will then be put under tension. “These cables serve to rigidify and compress the piers in order to increase their stability”, explains Daniel Guille.

A timetable kept to within 24 hours

P2 symbolises the success of the concrete work site. Although this pier is the focus of attention, it should not however overshadow the performance of the other work teams that have played their part in the construction of the different elements of the viaduct. Since the starting signal

for the construction site in November 2001, the north and south abutments are completely finished, as well as pier P1 (on the north side) and piers P6 and P7 (on the south side). Pier P5, for its part, is on the point of being completed. Piers P3 and P4 will bring up the rear. Between now and the end of the year, the civil engineering work on the viaduct will belong to the past... with the exception however of the toll barrier which will be located six kilometres to the north on the Causse rouge. “The key to our success lies for the most part on the good understanding and the motivation which prevails at the heart of the work teams”, Thomas Tiberghien, director of works, makes a point of stressing. “Each individual is really determined to contribute to the service of the work force as a whole, with a common goal: the completion of the construction. To within twenty-four hours, everything is proceeding according to the established schedule”. ■

Expansion: how it works

One of the particularities of the Millau viaduct resides in the way the deck is attached to the piers. On each of them, 16 cables composed of twenty-seven strands secure the metal structure to the concrete. It is therefore impossible for the deck to slide on top of the piers, which usually happens with bridges, when differences in temperature cause expansion phenomena. What is the solution? The head of each pier is fitted with several metal ball-and-socket joints on which the deck will rest. They will transmit the forces caused by the movements of the deck to the concrete. In conclusion, the flexibility of the piers will absorb the variations in the size of the deck *. The maximum amplitude will be recorded on piers P1 and P7 (the piers which are furthest apart), where it could reach 70 cm, the point “zero” of equilibrium being calculated for a temperature of 10° centigrade.

* Two expansion joints are also planned at the level of the abutments

Encounter

Long-lasting controlled tourist development

For Jean-Luc Gayraud, chairman of the Community of the Millau districts, the completion of the A75 motorway is a wonderful opportunity for the whole Millau area.

Talking about tourism in the Millau area is nothing new. “Since the beginning of the twentieth century, Parisians were able to buy a package which included the train ticket, a visit to the Tarn gorges and accommodation in one of the hotels belonging to the Compagnie du Midi”, recalls Jean-Luc Gayraud. It is certainly a long-standing tradition, but one which will experience a real revival with the arrival of the A75 motorway. “We are in a region exempt from tourist aberrations which have here and there spoil whole landscapes”, Jean-Luc Gayraud declares. The A75 motorway belongs to the second generation of motorways that take the environment fully into account.

Moreover, the opening up of the area it will bring us is the guarantee for the economic development of the region. For two or three years now, before even the motorway is finished, we have noticed a greatly increased number of visitors before the start of the summer holiday period. The promotion campaigns in Spain have attracted an increasing number of visitors from that country, especially during the Easter period”.

A high level of involvement shown by the local communities

To deal with the foreseeable increase in the number of visitors, Millau and its region are counting on the development of a long-lasting tourist industry. A policy which goes hand in hand with, among other things, the development of sites for outdoor sports (free flight, via ferrata...) allowing for increased numbers of participants, whilst guaranteeing respect for the environment. “These are facilities freely accessible to everybody, but administered by the local communities”, continues Jean-Luc Gayraud. “It is in this spirit that we have constructed a water sports park in the very heart of the town, so that lovers of outdoor sports can also benefit from all the infrastructures (hotels, restaurants...) which Millau can offer. As for accommodation, we are fully equipped with camping and caravan facilities. Moreover, we have begun to think about the development of a real residential holiday park... and we are ready to support any initiative which would improve hotel capacity and create quality accommodation, even in the very luxury category”. ■

Jean-Luc Gayraud, chairman of the Community of the Millau districts.

Zoom

When the pylons make their entrance

The manufacture of three of the seven pylons (steel masts carrying the cable stays) for the Millau viaduct has been entrusted to Munch, a company based in Frouard in the Lorraine region. A meeting with Etienne Royer, managing director.

Would you describe your company to us, and clarify your role in the construction of the Millau viaduct?

Created in 1909, Munch is a company that is specialised in boiler making and mechanical welding. Since 1994, we are part of the Eiffel group, and we are the leaders in France for the renovation of condensers for nuclear energy plants. We have contributed to the construction of several civil engineering structures, notably the Pont de Normandie for which we manufactured the central steel section. As concerns the Millau viaduct, we are responsible for the construction of three pylons: P1, P3 and P4 *.

At what stage is the work now?

Pylon P3 has already been erected and the cable stays connected – on the deck on the south side. The manufacture of pylon P4 is progressing. Its manufacture alone requires 15,000 work hours! It should be delivered at the beginning of 2004, at the same time as P1. I should point out that pylon P3 was assembled already in a vertical position, whereas P4 and P1 will be assembled horizontally, before being raised in one piece to the exact position where they will be secured.

What are the technical characteristics of the pylons?

The pylons are made up of three distinct sections, each of which is formed of several parts: the two legs (38.5 metres), the main body (31.5 metres), and the hat (17 metres). The different parts of the assembly will be rigidified by internal reinforcements in order to guarantee their perfect alignment. The points anchoring the pylons to the deck will be exactly vertically above the concrete piers and mounted on enormous mechanically welded caps.

What particular difficulties have you encountered?

We have to construct gigantic elements precisely to the millimetre. For example, the cable-stay anchorage points, all situated on the main body of the pylons, are each set at a precise angle. From the design stage for these pieces, it is imperative to allow for the inevitable distortions of the metal panels that the welding process will cause so that the result will be exactly as planned! The welding itself must also be beyond reproach. Some of the parts to be assembled require up to about fifty separate interventions.

How are the parts of the pylons brought as far as Millau?

The elements have dimensions of approximately five metres in width, four metres in height and twelve metres in length, with an average weight of eighty tons. All transport will be by exceptional road convoys with police escorts. They will leave the factory at night, to be able to cross Nancy without difficulty. ■

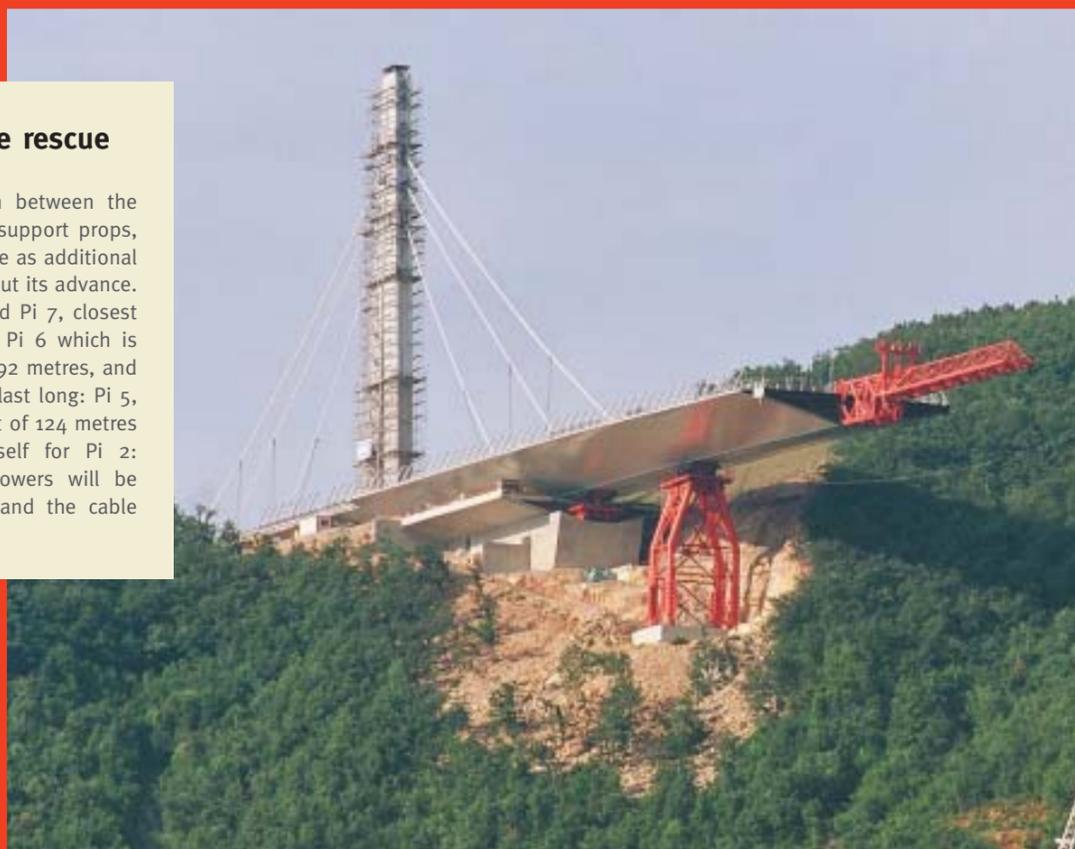
* Take care not to confuse the pylons with the piers, which have the same number!



A steel display between the two Causses

Temporary support pillars to the rescue

Gigantic bright red metal towers can be seen between the different piers of the viaduct. These temporary support props, constructed by Munch, a subsidiary of Eiffel, serve as additional resting points to support the steel deck throughout its advance. Today, three support props are finished: Pi 1 and Pi 7, closest to the north and south abutments, as well as Pi 6 which is currently the highest on the construction site at 92 metres, and weighing 700 tons. It is a record which will not last long: Pi 5, at present under construction, will reach a height of 124 metres and weigh 850 tons, before making way itself for Pi 2: 170 metres and 1,200 tons. These support towers will be dismantled once the deck has been installed and the cable stays permanently put under tension.



The deck, the temporary support props, the pylons and the cable-stays: the different metal parts of the viaduct have made their appearance one by one on the construction site. It is a perfectly orchestrated performance.

On both sides of the Tarn valley, all the actors are already in position. When the visitors leave Millau and go up the hill past Creissels towards the welcome area that has been reserved for them, they will discover a display that promises to be spectacular. To the left of the valley, on the south side, the steel deck of the future motorway is already on stage. After resting on the temporary support prop – Pi 7 for the initiates –, it reached and then passed the first pier. Pointing its bright red leading beak, it shows the direction to be followed, encouraging the spectator to look across the valley to the other side,

towards the north. Two and a half kilometres away, the other section of the deck has been brought to the edge of the abutment after a first “pushing” operation on solid ground carried out during the very first days of July. In May 2004, they will meet at a height of 250 metres, just above the river.

“More than 500 metres of deck have already been completed on the south side, and a further 200 metres of central box-girder sections have been assembled”, points out Jean-Pierre Gerner, director of works for Eiffel. He readily acknowledges that so far “the different phases in the launching operations of the decks have taken place without any significant problem”. For the third launching of the north deck, it is therefore more than 7,000 tons of

steel that the transfer jacks first lifted by 2 cm and then pushed out over the void in short 60-cm steps. Seventy hours of continuous work were necessary to carry out this launching of 171 metres successfully, with perfect synchronisation.

Pylons weighing 700 tons

On the south side, a first 70-metre pylon has been raised at the end of the deck and equipped with stay cables to support it on pier P7. Thus equipped, the deck cannot “nosedive” into the void between the temporary support pillars and the piers of the viaduct. The cable stays will be anchored to the middle of this steel mast. The final twenty-metre-high “hat”, which has only a purely aesthetic

function, will be erected at the end of the construction of the deck.

“The pylons are made up of various elements”, explains Jean-Pierre Gerner. “The heaviest weighs about a hundred tons, and the overall weight is close to 700 tons. It will take about a day to erect each of them. But before being able to consider assembling the next section, another two days will be necessary to carry out the welding and to erect the scaffolding”. A really giant Meccano assembled with the help of a hoisting crane whose operation is partly subject to the weather conditions: if Aeolus starts blowing at more than 40 kilometres an hour on the Larzac Causse, everything must be stopped. Security is paramount! ■

Cable stays: what stress!

On each side of the pylons, cable stays fan out and will be anchored to the deck. Six of them will be installed during the launching phase of the deck. Do you know what tension these elements are subjected to? In fact, there is not one answer, but several. It is all a question of the distance between the anchor point on the deck and the base of the pylon. For the shortest cable stays, this tension is equivalent to a force of 600 tons. For the longest, it attains 1,200 tons. For the same reason, the number of steel “threads” inserted into each of the casings depends on the length of the cable stay: 55 strands for the shortest, 75 or 91 for the longest.

Visitors

First class welcome



Their names are Camille, Marie, Martine, Gabriella, Séverine, Edith, Amélie and Aurélie. Under the leadership of Frédérique Alary, in charge of the visitors' welcome service, they make every effort to make the visit to the construction site an unforgettable experience. They are all guides who know the viaduct by heart. “With professionals from the building industry, we are asked very technical questions”, comments Martine, who has the advantage of having a husband who is in charge of the work site on pier P1. “They concern the type of concrete and steel used, the welding, the way of pushing the steel deck, etc.”. According to Gabriella, “the questions from the public are mostly about the crane

Visitors' welcome team: smiles and professionalism!

operators and how their cabins are equipped. The word “vertigo” crops up very often! Ecological issues also represent a large part of the visitors' preoccupations”, adds Marie. “They are reassured when we explain to them that the subject is one of our principal concerns, as demonstrated by the permanent presence of two environmental specialists on the construction site”.

Moreover, what do the visitors think? These are answers from some of them. “It is my third visit to the viaduct site”, points out Paul Amat, (Cournonterral, 34). “The first time I came with my family, the second time with friends and today it is in the company of the retired persons' club of which I am president. I enjoy following the

progress of this construction that is so spectacular. I do not want to miss anything!” “It is an enormous construction site... and how marvellous!” comments for her part Huberte Silferi (Authume, 39). “We having been coming to the Aveyron region on holiday for the past six years, and we took the opportunity to stop here, my husband and I. It is very beautiful... and we are really enthusiastic. We shall definitely come back again in 2004.” For Simone Albenois, (Montpellier, 34) “what impresses me most is this extraordinary amount of work, almost gigantic, all carried out in order to cross such a little river! The viaduct is going to prevent a lot of pollution. It is a prestigious undertaking for France”. ■

Aveyron inhabitants

Michel Wolkowitsky,
artistic director
of Sylvanès abbey

An architectural masterpiece



Nestling in the hollow of a small green valley, the Cistercian abbey of Sylvanès is a magical place where peace and serenity reign. Sixty kilometres from Millau, a visit to this building is a must for lovers of art, culture and religious chants. Every summer, the international festival of sacred music draws thousands of visitors.

"Sylvanès represents one of the high points of cultural tourism in the South Aveyron region, to the same extent as Roquefort and the Couvertoirade and soon... the Millau viaduct", confirms Michel Wolkowitsky, director of the abbey. "It is up to us to make sure that the people attracted by this new work of art have a desire to stay in the area". Several hundred people combine a visit to the Millau viaduct construction site with a concert at the abbey. "It is what we are already trying to promote", he continues, "through actions undertaken by the tourist office of the Roquefort area which groups the five

districts of the South Aveyron region".

"This viaduct is an excellent means of encouraging visitors to come to our area, but it also offers the advantage of bringing us closer to the other regions in France. Paris will only be five and a half hours away by car, and Montpellier just over an hour's drive away".

Christine Rols,
owner of the Les Rivages
camping site

The viaduct? A plus for the region

"The viaduct represents an undeniable plus for Millau and the surrounding area". Christine Rols, owner of the Les Rivages camping site, has no doubt about the positive consequences that the opening of the highest bridge in the world will bring. She is a real fan of her native region, and absolutely wants to make its wealth of resources known.

"Six or seven years ago, we still welcomed a large number of customers for whom Millau was a stopping-off town. Nowadays, because of the traffic jams, these same people have only one thought which is to escape from this blackspot as quickly as possible! By making the traffic move freely, our town will become attractive to tourists once more. We have wonderful assets. It is up to us to make the most of them so that the whole region benefits. Millau is a genuine hub from where it is possible to practise outdoor sports in spectacular scenery, such as the Tarn gorges or the Grands Causses regional natural park. Do not forget that the Mediterranean itself is only an hour and a half's drive away. On the cultural side, our heritage is also very rich. This is why we should immediately establish attractive tourist features, and create events in the off season. For a day, a weekend or a week: there is always something to do in the area". ■



Christine Rols,
owner of the Les Rivages camping site

Did you know ?

A little stone becomes a pier...

The 35,000 tons of "CEM I 52.5 CE" cement used for the construction of the viaduct piers are produced by a Lafarge factory in the Ardeche region. From its extraction from the quarry to its final use, how is cement manufactured?

Cement is the product used the most in the world for construction. It is a mineral powder which forms, on contact with water, a paste which sets and hardens progressively. It is therefore a "glue" for minerals, which allows concrete and mortars to be prepared. ■

The quarry

- The rocks (mainly limestone and slate) are extracted from the quarry,
- After being crushed, they are transported to the factory on conveyor belts.



Preparation of the raw material and its firing

- The crushed raw materials are stocked, homogenised and very finely ground to obtain a fine powder (the raw product),
- This powder is then fired at 1,500 °C centigrade, and then cooled in the open air,
- The material obtained is the "clinker", the base material of all cement.



Grinding, storing and packaging

- The clinker is finely ground together with gypsum to obtain pure cement,
- Additional ingredients are added to obtain composite cements,
- The cements are stored in silos
- Before being shipped in bulk or in sacks.



The transformation of cement into concrete

- Mixed with water, sand, aggregates and other additives, cement becomes concrete.
- The concrete is then poured into the formwork of the piers and abutments of the viaduct, thus coating the steel framework.

A brief description of Lafarge

- 1833: Auguste Pavin de Lafarge opens his first cement factory at Le Teil in the Ardeche region on the banks of the river Rhone,
- 1864: The factory wins the order for the Suez Canal for 110,000 tons of lime; it proves to be the starting point for the group's development,
- 2003: Le Teil celebrates its 170 years anniversary, after having accumulated prestigious references: the Palais de Chaillot, the Wall Street Stock Exchange in New York, the TGV Mediterranean high-speed train line...

Lafarge is the world leader for cement manufacture and construction materials.

Indicators



People

Queen and President

- The Compagnie Eiffage du Viaduc de Millau was present at the first International Architectural Rendezvous



which was held at Rotterdam from June 7 to July 7, 2003. In the context of this event, panels presented the viaduct and a film on the construction of this civil engineering project was also shown. On June 7, the opening day, Marc Legrand presented the viaduct to Queen Béatrix of the Netherlands.

- On May 21st, Jacques Blanc, President of the Languedoc-Roussillon regional Council, visited the construction site with Marc Legrand. ■

Eiffage at a glance

- The group has just delivered a drilling platform to BP destined to be set up in the Caspian Sea to exploit one of the world's largest reserves of petroleum.
- Work starts on the last tower at the Paris-La Defense district for the account of HRO, an American property developer. Situated in the last spot where building is permitted inside the ring road, this

building (ground floor plus 12 stories) will provide 31,000 m² of prestigious office space.

- In Italy, at Pont Ventoux in the Alps, an almost completely underground hydroelectric power station (with 28 kilometres of galleries and a factory in the heart of the mountain) is about to be completed, and will produce electricity for 500,000 people. ■



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