

viaduc

ÉDITÉ PAR LA COMPAGNIE EIFFAGE DU VIADUC DE MILLAU

“Get ready! The bridge is about to move”



About forty hours are enough to move the deck forward the 171 metres separating each pier from the next support tower. Every launching is a highpoint in the life of the construction site and requires several days' preparation. A report filed in the middle of the night.



green: the information sent by the various people in charge of checking that the transfer jacks are in perfect working order during the launching phases confirms that everything is absolutely normal.

Moreover, no significant movement of the piers or support towers is detected. Khaled chooses this moment to give another starting signal. In a few seconds, the 25,000 tons of the steel deck will be raised by two centimetres, moved forward sixty centimetres and then lowered again. A new launching cycle will then be able to begin again.

A kilometre and a half away, at the far end of the deck, conditions are very different

from the warmth of Khaled's office. It is eleven o'clock at night, and fatigue, the cold and the gusts of wind are taxing the resistance of the fifty workers or so who are making sure this new launching goes smoothly when a shudder underfoot indicates the steel is moving forwards. Beneath the clear, starlit sky, the perceived temperature is close to minus 16° C and the wind cuts through the thickest clothing. There is no escaping it! Fortunately, after a good thirty hours of effort, the docking of the deck on pier P4 is finally in sight. "It will have taken only a day and a half to advance the 171 metres", remarks Marc Buonomo, project manager for Eiffel. "At top speed, the deck moves forward at the rate of 8 metres an hour. Today we are reaching P4, and we expect in future to carry out a launch every four weeks, which is two weeks less than our original estimates".

A meticulous check-list

Each launching of the Millau viaduct follows a well-established procedure. Indeed, it is quite unthinkable to consider moving this vast steel ship forward over the void without having first satisfied a maximum number of requirements. This highpoint in the life of the construction site must be conducted with elaborate precautions to make sure it takes place successfully.

"It all begins with very stringent controls of all the welding and the geometry of the deck", stresses Jean-Pierre Gerner, the Eiffel director of works. "We also check that the anticorrosion protective coating has been well applied. It is only after carrying out these tests that we request the overall project manager to lift the ban on any movement. The permission to go ahead with a

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Check everything, control everything

The functioning of the transfer jacks, the sliding of the guides, the movement of the support tower or the positioning of the hydraulic jacks, Cédric Joie, an engineer, and Alain Tailledet, a welder, keep a constant watch on all the equipment on Pi 5. They must overlook nothing during their 10 hours on duty. "At the end of each cycle made by the transfer jacks, we check that everything is in perfect working order", Cédric explains. "This launch is a real celebration for the welders", adds Alain. "It is the fulfilment of our work".



Cédric Joie, engineer.



Khaled Sabbagh, systems engineer.

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launch depends on our submitting the documents detailing the tests we have run and on the approval of the measures to be taken in the case of an accidental halt, should there be a problem. We have to be able to place the structure in a secure position at any moment". All that then remains to do is to organise the schedule for the teams, prepare the launching equipment... and keep an eye on the weather! This is because nothing can start unless the Météo France national weather forecasting service can guarantee three consecutive days with conditions compatible with launching the deck, principally regarding the speed of the wind. "Preparing for a launch can take several days", explains Jean-Pierre Gerner. "Among other things, we have to adjust the height, check the mechanical, hydraulic and electric functioning of each piece of launching equipment, take new positional readings on the piers and support towers... and make sure that nothing can fall off the deck while it is moving!"

Making the docking secure

When the deck is only a few metres from its objective, the bright-red leading beak slides between two steel uprights –



Claude Reichert, surveyor.



known as the "rugby posts" by the initiates – providing a secure approach for the whole structure onto P4. They are not as wide as the deck itself, and will be disassembled afterwards to allow the deck to come to rest on top of the concrete pillar. This is the moment for the circular saws to come into play, creating impressive showers of sparks. The purpose is to detach these

pieces of steel weighing several tons from the top of the pier, and to transfer them onto the top of the deck with the help

Only two left!

Since that day at the end of February, the rhythm of launchings has been sustained. At the end of April, only two launchings are still to come before the final welding in June.

A trajectory controlled by GPS

Claude Reichert, a surveyor, follows the advance of the deck on his computer screen, minute by minute. "Thanks to GPS, we know at any moment if the position of the deck conforms to the calculated trajectory", he explains. "In fact the deck has a slight tendency to deviate more to the east than foreseen. This is due to its radius of curvature that creates a surcharge on that side on the support towers and piers. Whenever the difference exceeds one or two centimetres, it is necessary to redistribute the weight by using hydraulic jacks installed for this purpose".

Pi 3: the last piece of the jigsaw is in place

One was missing. It has arrived! The temporary support tower Pi 3 now occupies pride of place in the Millau sky. The Eiffel teams only needed just over two months to assemble the different sections of the last of the five enormous red steel cages which will support the deck until the stay cables have been placed under tension. Like a gigantic construction kit assembled under the open sky, it soars to almost 150 metres above the ground. What does it weigh? A thousand tons. The loads to which Pi 3 will be subjected during the forthcoming launching operations of the deck will cause the top to move horizontally about 30 centimetres, and to be compressed (under full pressure) by close to 8 centimetres. Movements that of course have been taken into account by the engineers and which in no manner endanger the stability of the structure. Resistance, flexibility and elasticity go particularly well together on the Millau viaduct construction site.



of a tracked crane. For at least an hour, the deck will remain immobile.

Five hundred metres away, on top of support tower Pi 5, Alain and Cédric are taking advantage of this break to have a bite to eat. They are using two tarpaulins as a makeshift shelter, just under the deck and more than 100 metres above the ground. The atmosphere is one of confidence, but there is now a biting cold. On the menu

tonight are a few sausages grilled on the barbecue, and a glass of mulled wine! There is only just time enough to get their strength back to be able to last out the long hours which await them before the launching operations are completed. Already at the leading beak the disassembly work is finished... and Khaled's voice rings out in all the earphones, like a new warning for everybody: "Get ready! The bridge is about to move". ■

The following morning...



The control post takes shape

Six kilometres to the north of the viaduct, work on another construction site has begun. In just a few months, the main work on the operational centre and the toll barrier has been completed.

It is a celebration of technological prowess. According to Vincent Bonnefous, Eiffage director of works, "the Millau viaduct toll barrier brings together on a single site the best of everything that exists today in the equipment field". Far from being simply a row of cash tills before drivers can gain access to the bridge, this barrier will become the nerve centre of the operational management of the structure. A true command post, operating 24 hours a day, every day of the year. The condition of the piers and the deck, surveillance and control of the traffic... the readings transmitted by the large number of sensors and video cameras installed at the strategic points of the viaduct will be centralised and analysed there. The police service, customs and the DDE environmental authority for the department will also be present on the site.

"In the control room, the supervisor will have to keep watch on the toll barrier as well as on the traffic on the viaduct itself, even if this is six kilometres further south", stresses Frédéric Dune, operational director for the Compagnie Eiffage du Viaduc de Millau (CEVM). "Cameras equipped with automatic incident detection will allow him to be alerted instantly should there be any anomalies on the roadway, such as a vehicle which has broken down, or a pedestrian walking on the emergency lane. It will be his responsibility to decide whether to send out a patrol vehicle to deal with the incident and, if



Vincent Bonnefous,
Eiffage director of works.

necessary, to activate the dynamic signalling (red lights, luminous pictograms, changeable message panels, etc.)."

Preservation of the environment

Construction work and the preparation of the toll barrier platform began on October 10, 2003. The main work is expected to be completed in May. By the beginning of November, all the equipment necessary for its operation should have been installed... and ready to receive the first drivers a few weeks later. "A passageway has been dug

under the toll booths", explains Vincent Bonnefous. "Besides the fact that this will allow the cashiers to reach their work stations without having to cross the lanes of traffic, it will also be used to install networks for ensuring the comfort and safety of the staff. The tollbooths will therefore be supplied with fresh air brought from an area well away from the traffic zone, and which will be slightly pressurised so that no exhaust fumes can inconvenience the cashiers. In addition, a pneumatic circuit will allow the cash receipts to be dispatched directly from the tollbooths to a strong room. No money will therefore be transferred above ground.

Particular care is given to the preservation of the environment at the toll barrier. A 400-metre-long wall will be built on either side of the main building to hide both the

carpark reserved for the staff as well as the brine preparation installations for salting the roadway if necessary. The finish of this wall will resemble the constructions in stone, typical of the region. "We have also made sure that rain



water flowing off the 12 hectares of the platform will not pollute the surrounding fields", explains Vincent Bonnefous. By means of a 2,500-cubic-metre holding reservoir, it will be possible to control the volume of water released onto the countryside. A decanting system for solid wastes, and a hydrocarbon filtration unit will separate out any residual pollutants". Of all the priorities to be respected on the construction site, the most important is the protection of the environment. ■

Voussoirs : a new challenge

On April 15, 2004 the last of the 53 voussoirs for the canopy of the toll barrier will be poured on the construction site on the C 0 abutment on the north side of the viaduct. A new challenge taken up by the teams of Eiffage TP: never before has the high-technology concrete BSI® - Ceracem, reputed for its resilience, been used for the construction of a structure on such a scale. Once the various parts have been assembled, the structure, like a gigantic 100-metre-long and 28-metre-wide twisted sheet of paper, will span the approach lanes to the 14 tollbooths. "Once the struts have been fixed in place, the voussoirs will be transported up to the toll barrier", explains

Jean-Marie Dolo, responsible for the canopy construction. To cover the six kilometres from here to the barrier, we shall use a self-propelled trailer that has 24 powered sets of four wheels: vital for transporting concrete sections weighing up to 70 tons! Once on site, a 450-ton-capacity crane will enable us to tilt the voussoirs into a horizontal position, put them in place and insert the pretension cables. These will then be placed under tension and the temporary support structures removed. Only the permanent struts will remain. At the end of June, the canopy should be in its final configuration.



Claude Pagès, co-ordinator of works.

In the image of the viaduct

"The toll barrier is being constructed in the same spirit as the viaduct. The shape of the control tower of the main building recalls the geometry of the piers, and the canopy echoes the lightness of the deck", points out Claude Pagès, co-ordinator of works on the toll barrier building. How far can refinement go...?"

Jean-Paul Bouyssou,
chairman of Ruban Bleu.



Aveyron inhabitants

An advantage for the economy and tourism

The opening of the Millau viaduct offers multiple advantages for the leading Roquefort cheese manufacturer, both as regards tourism as well as for economic reasons. Interviews.



Lyon-Brittany route picks up our cheeses. We only have a few minutes to transfer the goods. Having an extra hour will represent an enormous advantage. This is only one of the examples among others: with the viaduct,

the A75 motorway becomes a direct competitor with the TGV high-speed train or the aeroplane that you have to go to Montpellier to catch. An economic hub could be created in our region: the land is available, housing is less expensive than in large cities... and the landscape is superb". ■

*Frédéric Gallego,
commercial manager*

“The viaduct? A benefit for our distribution channels”

“The Millau viaduct will be a real “plus” for our distribution channels. For example, we are currently working on a very tight schedule to supply Clermont-Ferrand where a transport company on their

“Ideally placed”

“When the Millau bottleneck has been removed, part of the Paris-Spain traffic which uses the Rhone valley will be attracted to the A75 motorway. We will then also recover the drivers who now prefer to use the A20 motorway since the Cahors by-pass was opened to traffic last summer. Indeed, since it was put in service, we experienced a halt in the development of the business at the Regional Craft Centre that we manage on the Sévérac-le-Château rest area. The tendency should logically be reversed when the viaduct is completed. Moreover, our Roquefort cellars are ideally placed, less than 20 kilometres from the La Cavalerie exit. The number of visitors that we welcome each year (about 160,000 in 2003) will increase undoubtedly. ■

*Michel Laporte,
marketing manager*

The viaduct opens the holiday route!

School transport, excursions, tourist routes... The Ruban Bleu and Satar coaches have been transporting generations of Rodez inhabitants for more than fifty years. With seventy vehicles and a staff of about one hundred, the company is inescapable in the Aveyron prefecture! They are waiting impatiently for the future opening of the Millau viaduct. “A large part of the tours we organise leave for destinations in the south of France and Spain”, remarks Jean-Paul Bouyssou, chairman of the company. The A75 motorway represents for us the holiday route. With the opening of the viaduct, we shall easily save half-an-hour on all of our destinations. The viaduct toll is in no way a dissuasive factor in view of the advantages and economies that we shall gain from it. There is a real benefit, because crossing Millau has for a long time been a serious problem”.

“Besides the significant saving in journey times that it will permit, the viaduct is also a fantastic tourist attraction in itself. Since the

start of the construction site, Ruban Bleu has organised several hundred trips to the site, particularly for the staff of the DDE environmental authority for the department, for schools and colleges in the Rodez built-up area, or even for senior citizens’ associations. Soon, the simple fact of crossing the viaduct on a journey will be an event in itself. Even when the construction work has been finished, we shall continue to feature the structure on our tourist routes, in the same way as the other unusual features in the department”, concludes Jean-Paul Bouyssou. “However already, seen from Rodez, there is now business to Millau that we did not notice before. The viaduct has allowed the town to escape its anonymity”. ■



Millau inhabitants

A passion for the viaduct

If you want to discover all the little secrets about the Millau viaduct, here is a good address: the bar-restaurant des Voyageurs,



Géraldine and Jean-François Robion.

at Creissels. It is an imperative stopping place after the official visit to the Cazalou viewing platform! The reason is that Jean-François and Géraldine Robion – or rather, Loulou and Gégé – have two passions: their customers, who soon become friends... and the viaduct. The walls of the main room are smothered with maps and photos of the site, and the furniture is weighed down with helmets. “I sometimes have the impression of being a guide”, explains Loulou with amusement. “When tourists stop here, I

really enjoy telling them all I know about the viaduct. And when I overhear conversations full of errors about the bridge, I have a hard time not to interrupt”!

Loulou and Gégé took over the running of the business just over three years ago. If the passion for the viaduct quickly took hold, it is no coincidence: Jean-Pierre Martin, Eiffage director of the construction site, was their first customer! History was already written... Slowly but surely, the

restaurant has become “the annex” of the construction site. Every lunchtime, part of the teams meet there, welcomed virtually as part of the family. Moreover, Gégé knows everybody’s preferences by heart: no lentils for one customer on any account, apricot tart for another... and Roquefort all round! So, if you have the opportunity to stop at the Robions, keep an ear turned towards the large table in the centre of the room: you will have the chance of learning even more about the viaduct. ■

And the winner is...

In the context of Immotech 2004, an international exhibition dedicated to high technology in the construction industry, which was held in Geneva between 2-5 February, the Millau viaduct was given special pride of place. Consequently, it won the “Leonard Award”, a trophy attributed to civil engineering structures and public works projects recognised as outstanding for their technological performances. The reward was presented to Jean-Claude Mutel, director of the Compagnie Eiffage du Viaduc de Millau.

Visits

A Duke, European ministers and professionals: all at Millau!

• Distinguished visitors have been following each other onto the construction site since the beginning of the year. Among the notable visitors, Marc Forné Molné, head of the government of Andorra, Henri Grethen, Luxembourg Minister for Economy and Transport, Michel Daerden, Walloon Minister for the Budget, Infrastructure, Housing and Public Works... and the Duke of Edinburgh who spent

an hour at the beginning of April on the viaduct.

• Professionals have also arranged to meet at Millau on several occasions. Just such an opportunity occurred for the 29th “Days for the Management of Motorway Companies” when Marc Legrand, Managing Director of CEVM, welcomed a group to the construction site of close to 150 representatives of all the concession operators throughout France. At the end of April, the participants at the Symposium organised at Avignon by the FIB International Concrete Federation also made the journey to discover in detail the “secrets” of the highest bridge in the world! ■

250,000

This is the approximate number of visitors to have been welcomed to the Cazalou viewing area since the beginning of the construction.

Media

A great structure on the small screen

• TF1 dedicated several minutes of its 1 p.m. and 8 p.m. news broadcasts to the structure last March 30.

• After featuring in “E=M6” and “We tell you why”, the viaduct will again have the place of honour on France 3, in the ingenious programme “It’s not magic”, which appeals as much to

young people as to those not so young because it allows everybody to easily understand complicated things... The programme will discuss the Millau viaduct on Sunday May 16 at 10 a.m. For those who will not be able to be in front of their small screens then, relax: the programme will be rebroadcast on May 19. ■

Read in the press

The viaduct continues to have the honours of the press. As proof, the articles appearing in recent weeks. “The giants’ causeway” was the headline run by *Le Monde* 2, qualifying the viaduct as a “technological chef d’oeuvre already a major tourist attraction”. On the front page of *L’Auvergnat de Paris* can be read: “The Millau viaduct: Exceptional, its no ordinary construction site” or again “A construction site managed with mastery by the Eiffage group”. For *Le Pèlerin*, the viaduct is “the breathtaking bridge”, an “outstanding civil engineering structure”. *Capital* speaks of “surgical precision”, “technical daring” and “entirely original procedures”. To sum up, they all employ eulogistic vocabulary. Not forgetting the leading architectural magazines, with which the viaduct has proved a tremendous success. ■



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