Road surfacing: Appia paves the way

The Appia teams only needed three full working days to lay the road surfacing on the Millau viaduct. Carried out in record time, this operation transformed the steel deck into a motorway which will soon be ready to welcome cars and lorries. A flashback!

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A family affair

Appia, the road construction branch of the Eiffage Group, itself called on its various subsidiaries to make a success of laying the coating on the Millau viaduct. "Appia, the road construction branch of the Eiffage Group, itself called on its various subsidiaries to make a success of laying the coating on the Millau viaduct."* 9,000 tons for the traffic lanes and the central dividing section between the two roadways.

A few definitions

- The coating material is composed of several types of solids (pebbles, gravel and sand) bound together by bitumen. It constitutes the top layer of several sub-strata (bed, foundation, etc.) and it is on this surface that the traffic flows.

- Bitumen compounds are on the other hand mixtures of hydrocarbons and their sulphurous, nitrogenous and oxygenated by-products. They are often associated - incorrectly - with asphalt preparations, which are in fact bitumen compounds mixed with solid materials (sand or pulverulent rocks).  

What is hidden under the road

The role played by Appia is not limited to the road surfacing. A certain number of preliminary stages were necessary for this operation, which only represents the visible part of the iceberg, to be carried out satisfactorily! "Our role consists in laying a road on an existing surface," explains Marc Courtehoux. "But this surface - in this case steel - presents characteristics which have to be mastered perfectly: it becomes oxidised and it is slippery! We therefore had to find solutions for waterproofing the surface and to enable the coating to adhere to it perfectly." First step: pebble blasting. To what end? To eliminate the slightest trace of oxidation and to roughen the surface of the deck. To do so, steel ball bearings, a millimetre in diameter, were blasted under high pressure over the entire surface of the deck. More than 150 tons of ball bearings were used to carry out this operation. Once this stage had been completed, a primary coat was applied to the raw steel and a four-millimetre-thick bituminous sheet was hot welded at 400 degrees centigrade to the 65,000 m² of the deck. Perfect protection against oxidation... and a specially designed surface to receive the coating in all security.  

Three questions for...

Daniel Calinaud, chairman of Appia

Appia was selected to lay the surfacing on the Millau viaduct. How did you respond to this challenge? The development of a specific surfacing proved to be a real test for all the teams at our research laboratory at Corbas, near Lyon. This enabled us to demonstrate our innovative capacity when faced with an exceptional situation. Two years of studies and tests were necessary to determine the ideal formula for the viaduct’s bitumens and to check its durability. In January 2004, the conformity specifications were submitted to Setra. When the surfacing was laid at the end of September, everything was in place so that the operation could be carried out in the best possible conditions.

How was your co-operation with the other companies of the Eiffage group already present on the viaduct? The work we did at Millau enabled us to develop true synergies with Eiffel, Eiffage TF, Forchum, etc. I would underline the fact that this is the first time we have collaborated so extensively to lay tarmac on steel. Our technical services worked together perfectly, a fact which enabled us to reach the clearest possible understanding of how the two materials interact.

The laying of the road surface was covered by all the media. What does such an exposed work site represent for you? The Millau viaduct is without question an exceptional showcase for Appia. It placed our company at centre stage to an extent it had never experienced before. It highlighted our expertise, and demonstrates the overall success of the Eiffage group.
A specific surfacing extensively tested!

At first sight, nothing distinguishes the Millau viaduct coating from an ordinary roadway surfacing. Nevertheless, the Appia research teams needed no less than two years work to develop a high technology product capable of meeting the constraints set by the structure.

Laying a coating on a metal surface bears no relation to carrying out the same work for a normal roadway. Indeed, the deck's steel is subject to multiple deformations throughout its life and is subject to the constant passage of vehicles immediately above the welding of the reinforcements to the plates would provoke cracks in the tarmac. Such deterioration would rapidly provoke the road surfacing to separate from the deck, causing it to lose its waterproof properties. Unthinkable on the Millau viaduct! For almost two years, the teams of the Appia research laboratory situated in Corbas (Rhône) therefore worked flat out in search of the ideal bitumen formula capable of solving this problem. Without neglecting the other criteria for a motorway bitumen worthy of the name (density, texture, adhesion, etc.). "We tested about fifteen bitumen formulas before developing the bitumen which corresponded exactly to our requirements", explains Bernard Heitier, the Appia technical director. "We chose materials known for their ability to resist rutting. We added components (polymers, etc.) corresponding to the rubbery consistency we wished the bitumen to have. We were searching for a formula which would be flexible enough to absorb the deformations of the steel, yet resistant enough to maintain its initial properties".

A week of non-stop torture

The first technical tests began as from January 2003. Each prototype was submitted to a battery of tests. Placed in a machine specially designed for the purpose, the different samples of the steel plateing, waterproofing, bitumen complexes were subjected to vertical pressures simulating the road traffic. Tested by the equivalent of two million vehicles at the internal rate of four a second at a temperature of 10 degrees centigrade! A week of non-stop torture carried out under perfectly controlled conditions to respect the guidelines of conformity set by the material. "At the same time as we were carrying out these simulations, the Ponts et Chaussées laboratory ran a series of cross-sectional tests", adds Bernard Heitier. "We wanted to be sure that there were no flaws in the different layers between the steel, the waterproof sheet and the bituminous surfacing". During the spring of 2004, a test was run at Rivesaltes (Pyrénées-Orientales) on a replica of a cross girder section provided by Eiffel. At the end of July, a full scale trial of laying the tarmac was conducted on the deck itself. All these were indispensable stages to make sure that vehicles can cross the viaduct in a maximum of comfort.

Freyssinet installed the stay cables...

Freyssinet achieved a truly amazing feat in only three months: securing the stay cables to the seven pylons of the viaduct. By the end of August, the structure had adopted its definitive configuration for everyone to see.

A sprint. Jean-Luc Bringer, site director for Freyssinet, makes this quite clear: "Attaching the 130 stay cables was carried out in an extremely short time. Indeed, the work was completed in only twelve weeks. We started on June 16th, and completed everything by the end of August. At least almost everything! A few less visible tasks still remain to be carried out between now and the opening of the viaduct: the final adjustment of the tension of the stay cables, installation of the anti-vibration shock absorbers, the positioning of the waterproof covers at the fixation points, etc. A work of precision which calls upon the skills of a task force of close to one hundred people per week. Each stay cable is made up of a polyethylene sheath containing between 55 and 91 steel cables (strands) depending on the overall length of the stay cable. The strands are themselves each made up of 7 steel wires, a central wire with six wires twisted around it. The stay cables are erected simultaneously opposite each other, pylons by pylon, following a perfectly tested technique. “A master strand is inserted into the sheath while it is still on the ground”, explains Jean-Luc Bringer. "The sheath is then hoisted up the pylons with the help of a winch until it reaches its definitive position. The strand is then inserted into its upper and lower anchorage points, and then placed under tension. A "shuttle" enables the other strands to be brought one by one into position. Specific equipment is then used to subject them all to a strictly identical tension". In total, more than 900 tons for the longest stay cables: enough to support at least twenty articulated lorries! The Millau viaduct benefits from all the latest technology developed by Freyssinet. Every strand is protected against corrosion by a triple protection: after galvanisation and coating in petroleum wax, they are meshed in an extruded polyethylene. The external sheath (to ultraviolet rays) possesses, for its part, a double spiral the full length of its surface. Its purpose is to prevent any water from running along the stay cable which otherwise, by altering its profile, could cause oscillations, under strong winds, of more than a metre, thereby even affecting the stability of the viaduct itself. As regards maintenance, six stay cables have been equipped with instruments. Accelerometers and acoustic probes will enable their condition to be monitored. A permanent check-up guaranteeing they will remain in perfect condition for the next 120 years!".

The viaduct’s new visual identity

As soon as the viaduct is opened to the public, all public relations activities aimed at making the advantages of the viaduct known to European users will focus on the brand identity. The Millau Viaduct - Eiffage, the image of each serving to promote the other. All visual representations will reflect this new identity: logo, stationery, vehicles, uniforms...

Highlighting the structure

Eiffage at a glance

• Through its subsidiary responsible for public car park concessions, and its new acquisition Epolis, Eiffage becomes the second largest car park operator in France.
The viaduct in all serenity

The tourists visiting the Cazalous viewing area ask quantities of questions about traffic conditions on the viaduct. Answers from Jean-Claude Mutel, director of the Compagnie Eiffage du Viaduc de Millau.

Are people likely to suffer from vertigo when they travel across the viaduct?

Not at all! The viaduct is just like a 2x2 lane motorway completed by a 3-metre-wide hard shoulder. This is lined by a crash barrier with an outer corner 2.15 metres wide surrounded by windbreak screens. A driver can therefore only have a horizontal view of the panorama... but no view down into the valley.

What happens in the case of a breakdown?

The system is identical to that of an ordinary motorway. You just have to park on the hard shoulder and call for help at one of the emergency telephones placed every 500 metres. Besides, video cameras which automatically detect every incident enable us to locate anything unusual on the roadway. The surveillance centre positioned next to the road will then be immediately alerted. In a few minutes, the motorway patrol will be on the scene of the accident.

At what speed can one drive on the viaduct?

The viaduct possesses this configuration of a "normal" motorway. The speed limit is therefore 130 kilometres per hour for cars. Lorries will be subject to the usual motorway restrictions.

What precautions should be taken in the case of high winds?

Three-metre-high screens running the entire length of the structure cut the wind speed by 10%. There will therefore be less wind on the viaduct roadway than on the surrounding causse. In other words, in the case of blustery weather crossing the viaduct will present no problem! It should be noted however that the structure is guaranteed against winds of 245 kilometres per hour. Something never encountered in the region.

What should be done in the case of an accident?

A specific rescue procedure approved by the protection has been established. It covers not only the means of intervention but also their organisation. From the motorists’ point of view, information panels have been set up and a system for closing the viaduct can be activated.

Have you planned for freezing weather?

Of course! Meteorological stations are in place on the viaduct and temperature sensors are imbedded in the roadway. We also have at our disposal all the infrastructure necessary to salt the viaduct and to ensure its winter viability.

Souvenirs, souvenirs...

Visitors have been asking for it with insistence at the Cazalous viewing area... here it is at last! The viaduct shop was opened last July 21st. Customers have been waiting for it for a long time. T-shirts with the viaduct logo are now on sale. A full range of souvenirs have also been established. It covers not only the symbolic number of half a million visitors but also their organisation. From the motorists’ point of view, information panels have been set up and a system for closing the viaduct can be activated.

Have you already noticed any positive repercussions on the local economy?

Local businesses are already profiting from the “viaduct effect”. Three restaurants and two hotels have seen their business grow very considerably. A hypermarket has just opened at the bottom of the incline leading to the foot of the viaduct. Finally a car dealer and a pottery have opened recently in our area.

An increase in tourists brings with it an increase in traffic. How do you intend to handle this traffic surplus on your commune?

The département road 992 which crosses Creissels will undergo some slight modifications. Indeed, these will lead to the creation of two lanes of uphill traffic with a single downhill lane between the centre of the village and the viaduct with the financial assistance of the department. This will improve the safety of the roadside inhabitants.

As mayor, but also as a citizen and native of Creissels, what is your personal impression of the viaduct?

First of all as a mayor, I am particularly proud that such a monumental structure has been constructed on my commune and to have participated myself in a number of meetings concerning the construction. I would never have imagined that more than 400,000 visitors would cross the village over a period of a few months! As a citizen, I am filled with admiration for the work force, the precision of their gestures... and the great kindness of their directors.

Meeting with Pierre Garlenc, mayor of Creissels.

The viaduct has now become a reality. Does it represent an opportunity for your commune? Absolutely! It is a true chance for Creissels. This national and international technological showcase will undoubtedly strengthen the tourist attraction to the South of our country and to our village in particular. In the mid term, we are going to take every possible step to profit from the boost this unique structure has brought us linking the Cause rouge to the Larzac plateau.

Does the construction of the viaduct bring with it economic growth for the commune?

The revision of the local urbanisation plan (PLU) will lead to the development, at the western approach to the Millau-built-up area, of the Creissels' centre and an urban development zone (ZAC). These two projects will be carried out in collaboration with the Community of the Millau-Grands Causses commune which possesses the necessary expertise for everything concerning the development of the economy and tourism. They should give Creissels a dimension of a proper urban centre.

Have you noticed any positive repercussions on the lives of the Creissels’ inhabitants?

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