

# ACI Excellence Awards – 2016

## Run-of-river dam in Chatou – Infrastructure

### Project Information

Please choose the category for your project [Infrastructure]

Name of Project [Chatou Dam]

Address [3, quai Watier, 78400 Chatou]

Country [France]

City [Chatou]

State - Postal Code [78400]

Project Size (Dimensions) [120 meters]

Concrete Quantity - Volume [about 22 000 m<sup>3</sup>]

Formwork Quantity - Area [about 8 000 m<sup>2</sup>]

Reinforcement Quantity - Tonnage [about 1 600 t]

Concrete Work Duration [2005-2014]

Date of Project Completion [23/12/2014]

### Overall Project Description

Immediately downstream from Paris, the Chatou Dam regulates the Seine River's water level to allow navigation as well as to ensure flood control. It is the largest fluvial hinged-crest gate dam in France. It includes a fish way set in the river bank and, more generally, applies the global environmental strategy adopted by the client, the French Waterways public corporation.

The dam is located in the protected "Impressionists Island" scenic and cultural area, which attracts visitors from around the world. Updating the bulky, degraded dam from the early 20th century therefore involved careful attention not only to its complex technical functions, but also to its perfect architectural, environmental and landscape integration in a particularly sensitive context.

With that in mind, the engineers and architects associated functional and structural optimization with research on concrete performance when designing the new run-of-river dam, which is much more discreet than the prior installation. Contrary to its predecessor, the dam offers the Seine's curve for visual perception, and its sculpted concrete provides the image of an authentic "River Monument".

The complex abutments and piers incorporate stairways, mechanical, electrical and plumbing lines, technical rooms and housings for different functional components (gates, cylinders, cofferdams). Their design details and the particular care taken for crafting the parts above water give them a forceful expressive character.

As an evocation of the impressionist painters' universe, the waterfall and concrete surfaces are lit with colors that vary with time, weather and the seasons, creating a surprising pictorial effect for the whole structure that enhances the river's motion as much as the engineering lines.

## Concrete Description

The new Chatou run-of-river dam is primarily a hydraulic structure on the Seine River. However, it has been designed to look more like a bridge and its structural design also follows Eurocode 2.

Each of the three ways of the new facility required 1 000 m<sup>3</sup> of concrete by pier (or bank abutment) and 3 000 m<sup>3</sup> by raft foundation between each pile. For each way concreting operations should last about 4 months, spread over a period of 8 months due to regulatory constraints associated with construction works along the river. Concrete placement rates over 30 m<sup>3</sup>/h were achieved despite technical and transport restrictions.

The raft foundation is a massive concrete block with a width of 22 m and a thickness of between 2.10 m and 4.80 m. It was placed in two lifts, a first layer 2.10 m thick and a second layer up to finished surface level. The piers have a width of 4 m and a height of 17 m. The massive sections of the piers were cast in-situ in order to ensure stability and waterproofing of the dam. The exposed sections which are patterned and the stairs were precast to ensure a suitable finish and to optimize the time of works in the riverbed.

The thickness of the piers was reduced to minimize their hydraulic effects. Therefore, reinforcement and concreting works were carried out in a confined space. The intense loads imposed to the jack supports at opening gates and also on top of the footbridge supports required a high reinforcement ratio, about 120 kg/m<sup>3</sup>, which resulted in complex vibration operations (required for obtaining smooth finish).

The concrete mix-design was defined to meet several requirements: high resistance for the structures highly stressed such as the piers and abutments, a low heat of hydration, a significant fluidity and a guaranteed uniformity of color. The chosen concrete, C40/50-XF1-G1-CEM-III-SC5, is composed of small-size aggregate of between 4 and 12 millimeters to favor the placement of concrete in confined areas. A cement of class 32.5 with low heat of hydration was used, and the curing temperature was controlled using the results of a thermo-mechanical study of the concreting and early-age operations to minimize shrinkage and favor superior durability.

The piers and abutments were cast in three lifts, the first to the upper level of the raft foundation (+15.80), the second to the normal water level (+23.80) and the third to the final level (+28.34).

Concreting operations were performed using prefabricated plywood formworks assembled on a timber frame, and were reused for each pier. These two-side formwork structures were supported by two form walls with a length of 26 m and height of 8 m. This type of formwork was chosen to ensure a fine facings aspect and to meet a tolerance of  $\pm 1$  mm along the contact with the tilting gates. Fulfilling this requirement made it possible to treat contact areas only with epoxy resin while ensuring a high-quality supporting concrete surface.

# Construction Team Members

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**Sponsoring Chapter: ACI Paris Chapter**

Name of Chapter Contact (Name of the representative of the Sponsoring Chapter who invited the submitter to submit the entry)

[François Toutlemonde, president of ACI Paris Chapter]



Figure 1: The old dam (on the right) and the new one, increase in visual elegance.

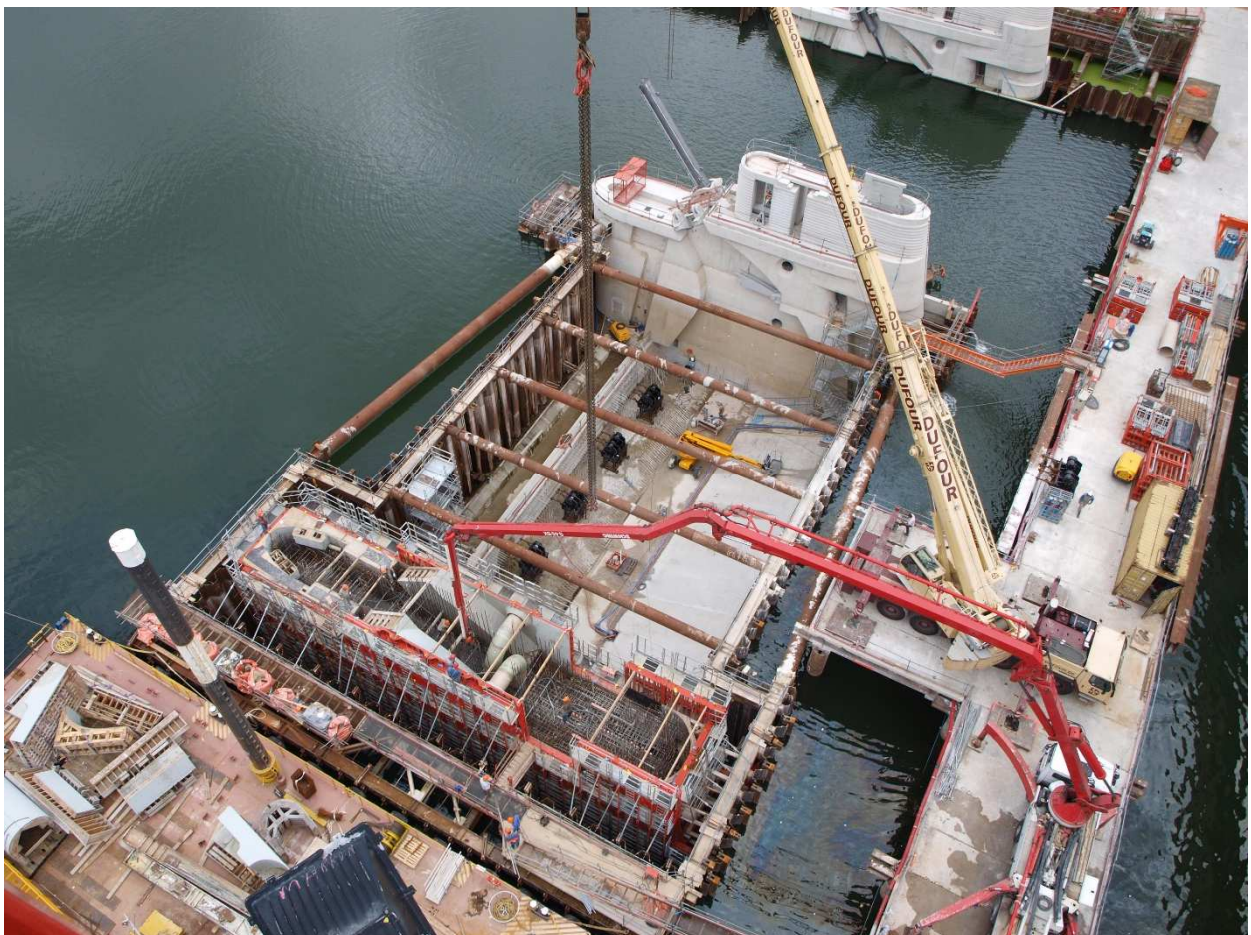


Figure 2: Concreting operations of a pier and raft.





Figure 3: General view from downstream.



Figure 4: Detail of a finished pier and gate.



Figure 5: Quality of concrete surfaces and geometrical precision.

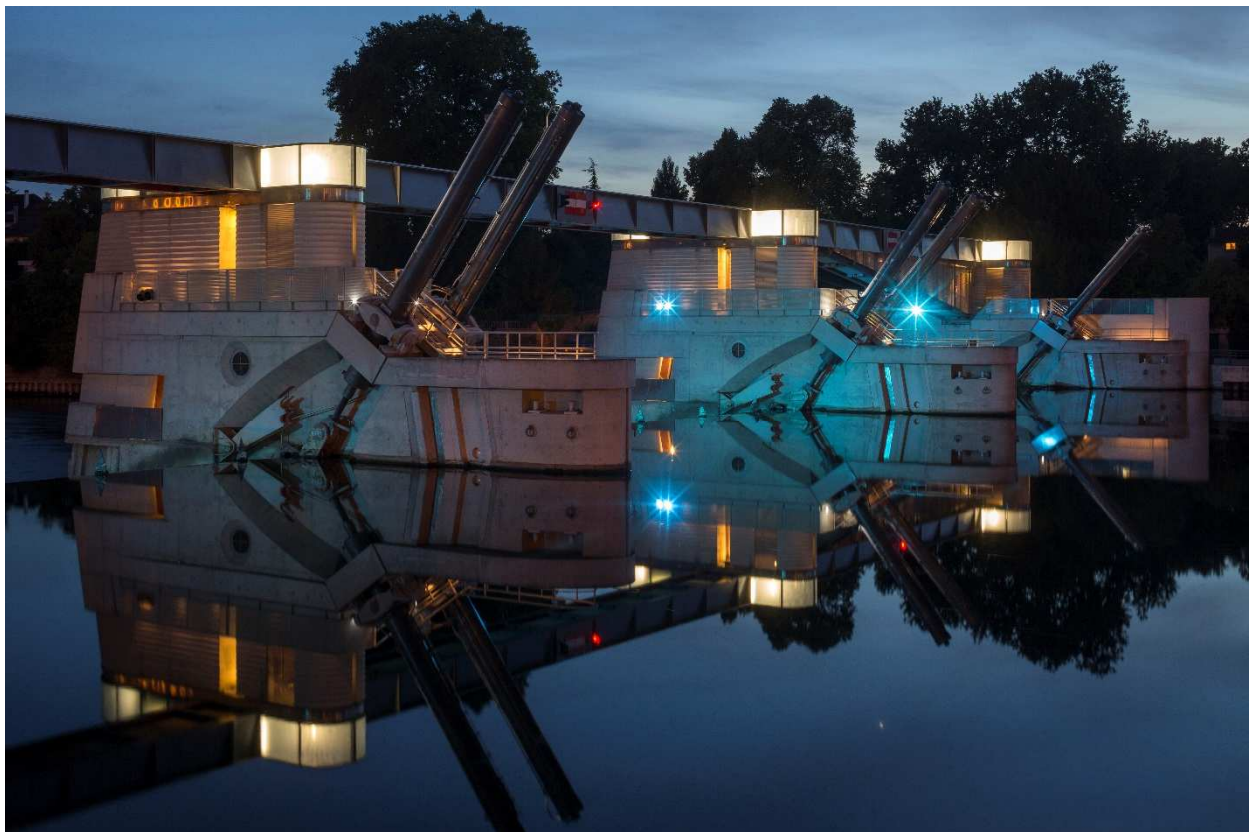


Figure 6: Evening white and blue mirror effect.





Figure 7: The concrete structure under night colors.



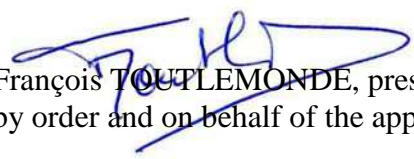
Figure 8: The new scenery of River Seine and Impressionists' Island.



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François TOUTLEMONDE, president of ACI Paris Chapter,  
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