

FRCM Strengthening of the Buttresses

The Aghlabid Basins, Kairouan, Tunisia

Structural Strengthening





Removal of the original lime-based render.

The Aghlabid Basins, built in the 9th century to supply water to Kairouan, stand as a UNESCO-recognized masterpiece of Islamic hydraulic engineering and medieval ingenuity.

Project description

The Aghlabid Basins, constructed between 860 and 862 AD under the Aghlabid dynasty, are among the finest examples of hydraulic engineering in the medieval Islamic world. Built to supply water to the city of Kairouan – the historical capital of Arab empires in Tunisia – they formed part of an extensive hydraulic network comprising approximately fifteen reservoirs.

Recognized as part of the [UNESCO World Heritage Site “Kairouan”](#) since 1988, the basins are constructed from rubble masonry and occupy an area of approximately 11,000 m², with a total storage capacity of nearly 68,800 m³. The complex consists of a 17-sided decantation basin and a 64-sided storage basin, both stabilized by a total of [227 masonry buttresses](#), which are essential to the structural stability of these historic hydraulic structures.

As part of an extensive conservation and restoration program, deteriorated structural elements required strengthening while fully respecting the historical authenticity and heritage value of this internationally protected monument.

Project requirements

The restoration formed part of a comprehensive conservation program aimed at preserving one of Tunisia's most significant historic monuments while complying with the strict principles governing UNESCO World Heritage sites.

Structural investigations identified diagonal cracking affecting several masonry buttresses in both basins, requiring structural strengthening to restore their load-bearing capacity. The intervention had to remain fully compatible with the original lime-based masonry construction while minimizing its visual and physical impact on the historic fabric. To preserve the authenticity of the monument, the selected strengthening solution had to be cement-free, compatible with traditional lime-based materials, and designed as a minimally invasive system that could integrate seamlessly with future conservation work.



Condition of buttresses showing diagonal cracks.

Project solutions

To satisfy the demanding conservation and structural requirements of this UNESCO World Heritage Site, Sika developed a mineral-based FRCM (Fabric Reinforced Cementitious Matrix) strengthening system combining Sika CarboDur®-300 Grid, SikaEmaco® S 285 TIX, and SikaWrap® FX-50 C.

The strengthening system consists of Sika CarboDur®-300 Grid embedded within the cement-free, lime-based repair mortar SikaEmaco® S 285 TIX. The system is completed using SikaWrap® FX-50 C carbon fibre strands, providing mechanical anchorage of the grid and ensuring efficient load transfer throughout the masonry.

In total, 20 internal buttresses and one masonry vault required structural strengthening. The reinforcement was applied across the full width of each buttress, extending approximately 50 cm beyond each side of the wall over a height of approximately 2.5 m, ensuring effective stress redistribution and confinement of the cracked areas. The strengthened vault covered an area of approximately 12 m², resulting in a total treated surface of approximately 250 m².

The repair works also incorporated SikaFiber®-200 Vegetal cellulose fibres into the lime-based repair mortar used for masonry restoration. The natural fibres improve cohesion, reduce shrinkage cracking, and enhance the mechanical performance of the repair material while remaining fully compatible with the conservation requirements of the historic structure.



Application of the Sika CarboDur®Grid+ SikaEmaco®S 285 TIX System.

This combination of mineral-based composite strengthening technology and lime-compatible repair materials successfully restored the structural capacity of the damaged masonry while fully respecting the historical authenticity of the monument. The intervention provides a durable and minimally invasive solution that meets the stringent conservation requirements applicable to UNESCO World Heritage sites.

Technical service and engineering support

Sika Tunisia worked closely with the project designers, engineers, and specialist contractor during the selection and implementation of the strengthening system. Technical support focused on identifying a solution fully compatible with the historic lime-based masonry while meeting the structural performance requirements of the restoration project.

The combination of engineering expertise, material compatibility, and practical application support ensured the successful execution of this highly specialized heritage conservation project.

The works were carried out during April and May 2026.



Project participants	
Project owner	Ministry of Cultural Affairs / Saudi Fund for Development / National Heritage Institute
Architect	T2a Architecture
Engineer	BFM Engineering
Main contractor	Société Bouzguenda Frères (SBF)
Sub-contractor	STRAM
Sika Organization	Sika Tunisia SARL



Completed strengthening system with SikaWrap® FX-50 C.



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