

## UNESCO World Heritage Site: Takht-e Soleyman Preservation of a Cultural Monument



<b>Location</b>	West Azerbaijan, Iran
<b>Overview</b>	<p>Schoeck Combar was used on stabilising Western Ivan, the tallest building in the complex. The major damage was caused by vertical cracks in the eastern part of the wall a caused by two different construction phases. Many holes and cavities had to be repaired with the injection mortar specially developed for this purpose. The interesting thing about this masonry is that at that time high-fire gypsum was used as an adhesive between the stones. Therefore, we also take the same mortar starting material and thus do not achieve any harmful reactions in the masonry.</p> <p>The upper half of the buttress was additionally secured in two levels, each with two glass fibre rods in the longitudinal direction. With the twist drilling method, boreholes with a length of approximately 2.40 meters were drilled. The holes had a diameter of about 32 millimeters. After that, the boreholes were flushed out with water to remove the drilling powder. The combar glass fibre rod with a diameter of 12 millimetres from Schöck Bauteile GmbH was used in the middle of each borehole. Subsequently, the boreholes had to be pressed with the suspension. Dr. Toralf Burkert: "We know Schöck Combar from another project in Iran, the Citadel of Bam. It is the largest clay castle in the world and was almost 90 percent destroyed by a severe earthquake in 2003. In 2006, Jäger Ingenieure GmbH was commissioned to rebuild a historic mud house. Here we used fiber optic reinforcement. As a result, the building could be constructed earthquake-proof. There we needed reinforcement elements in the cross-sections, which also absorb and distribute the tensile forces in the event of an earthquake. Wood as a material was omitted because there are termites there. In Iran, only black steel is available at moderate prices and since the soil here is highly saline, this would promote corrosion. So we needed a neutral, resistant material and that's when we came up with Schöck Combar. The main advantage of this material is that it has enormous tensile strength, no corrosion problems, very good bonding behavior and high durability. In addition, Combar is much lighter than steel. Thanks to these good experiences, we have of course also reused the glass fibre rods on the Takht-e Soleyman."</p>
<b>The challenge</b>	Corrosion of carbon steel in concrete, increased concrete cover, long term costs due to concrete repairs.
<b>The solution</b>	As a solution Schoeck Combar GFRP non-corrosive reinforcement bar was used. With all the benefits it helped to reduce CO2 emissions and increase a lifetime of the structure.
<b>Materials used</b>	GFRP- Schoeck Combar
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• 100-year design lifetime guarantee and long term performance tests</li> <li>• Works well with low carbon cement or geopolymer</li> <li>• 3 x times lighter than carbon steel</li> <li>• Great long term and short term bond performance</li> <li>• Reduced work on site</li> <li>• H&amp;S benefits</li> <li>• Easy machinable material</li> <li>• Less material weight vs Carbon steel</li> </ul>
<b>Client</b>	Iranian Cultural Heritage Authority and financial support from the Cultural Preservation Programme of the Federal Foreign Office of the Federal Republic of Germany
<b>Supplier</b>	Schoeck Ltd
<b>Further details</b>	<b>Website:</b> <a href="http://www.schoeck.com">www.schoeck.com</a>