

Tower Construction in the Himalayas: Swiss Stability

This story covers more than 7000 km and takes place in two similarly small nations. For the reconstruction of a historical tower in the Himalayan kingdom of Bhutan, Angst + Pfister Switzerland has contributed the APSOPUR® damping mats for the building's vibration isolation. They will protect the building from seismic vibrations. This story, however, is also one about human courage.

The flames shot up high into the night sky across the Himalayas. On 12 June 2012, a fierce fire destroyed the Wangdue Phodrang Dzong. The firefighters were not able to save the mighty architectural complex from the 17th century, which looked down on the valley from the top of a rock spur. It was primarily built out of stone, clay and wood, and was only accessible from one side. The catastrophe had most likely been caused by a short circuit.

The Loss of a Cultural Monument

In that night, the little kingdom of Bhutan, located east of Nepal and south of Tibet, lost one of its most famous buildings: Dzongs are fortresses and Buddhist temples in one. Built in strategically crucial positions, one of its wings bears the local district administration, whereas the other holds a religious centre, usually a monastery. A high, mighty tower, the Utse, stands in the centre of each Dzong. The Wangdue Phodrang Dzong had just been registered as a UNESCO World Heritage Site by the government in March 2012.

Seismic Activity in the Himalayas

On 25 April 2015, not even three years after the catastrophic fire, a massive earth-

quake hits wide regions of Nepal. Strong aftershocks follow. The Nepalese government estimates the number of victims to be 8800. At that time, the Swiss engineer Andreas Galmarini is staying in Bhutan for half a year – more about this in the second text on this topic. From the capital city of Thimphu, he travels across the 3140-metre-high Dochula Pass into the Punakha Valley to visit the Wangdue Phodrang Dzong. Its reconstruction has already begun.

Evaluating the seismic activity in the Himalayan region, where two tectonic plates press against each other, encourages Andreas Galmarini in his decision: the new tower of the Wangdue Phodrang Dzong must be isolated against vibrations and must also be mounted elastically. He initiates the first technical evaluations together with his father's engineering office WaltGalmarini in Zurich.

With the Help of Friends

Father Carlo Galmarini is also getting involved and contacts Christof Domeisen, Chief Executive Officer of the Angst + Pfister Group. Both are members of the same service club. And thus the technical works gather momentum. Arno Vinzens, who specialises

in vibration isolation at Angst + Pfister, selects the appropriate mats from the broad APSOPUR® selection. They have exactly the right density, which has been calculated by the engineers at WaltGalmarini to be necessary in order to protect the tower of the Wangdue Phodrang Dzong from earthquakes.

The tailor-made mats are then delivered to a steel production company in Switzerland. Here, the antivibration mats are tightened in between two steel plates, so that their entire surface can deflect. Afterwards, they are brought to Asia by ship during a three-month journey. Lorries transport them via high mountain passes and across narrow, partially unsurfaced roads, to the construction site of the Wangdue Phodrang Dzong.

A Sensational Construction Site

In February 2016 the vibration isolation is installed. Additional bearings are also mounted, where a teflon layer slides across a stainless steel sheet. The mounting as such reminds of bridge building. Andreas Galmarini travels to Bhutan again in order to supervise the process. The installation is a sensation for the workers, many of them wearing their traditional clothing, the

so-called Gho, as they capture the event with their smartphones. Tradition meets modernity, both in terms of isolation technology and in communication alike. Buddhist monks speak their blessings in a special ceremony. Dawa Gyaltshen, the Interior Minister of Bhutan, had already thanked Angst + Pfister for the elastomer mats in an

official letter: "This type of isolation is the first of its kind in Bhutan. Your gift is a milestone for us. It will contribute to improving the construction of traditional structures in Bhutan." The APSOPUR® isolation mats now lie under the concrete base plate and the stone walls built on top of it. Their pretension will be released as soon as the four-storied

tower of the new Wangdue Phodrang Dzong has been completed. As of today, the entire Wangdue Phodrang Dzong is set to be completed by 2018. >>



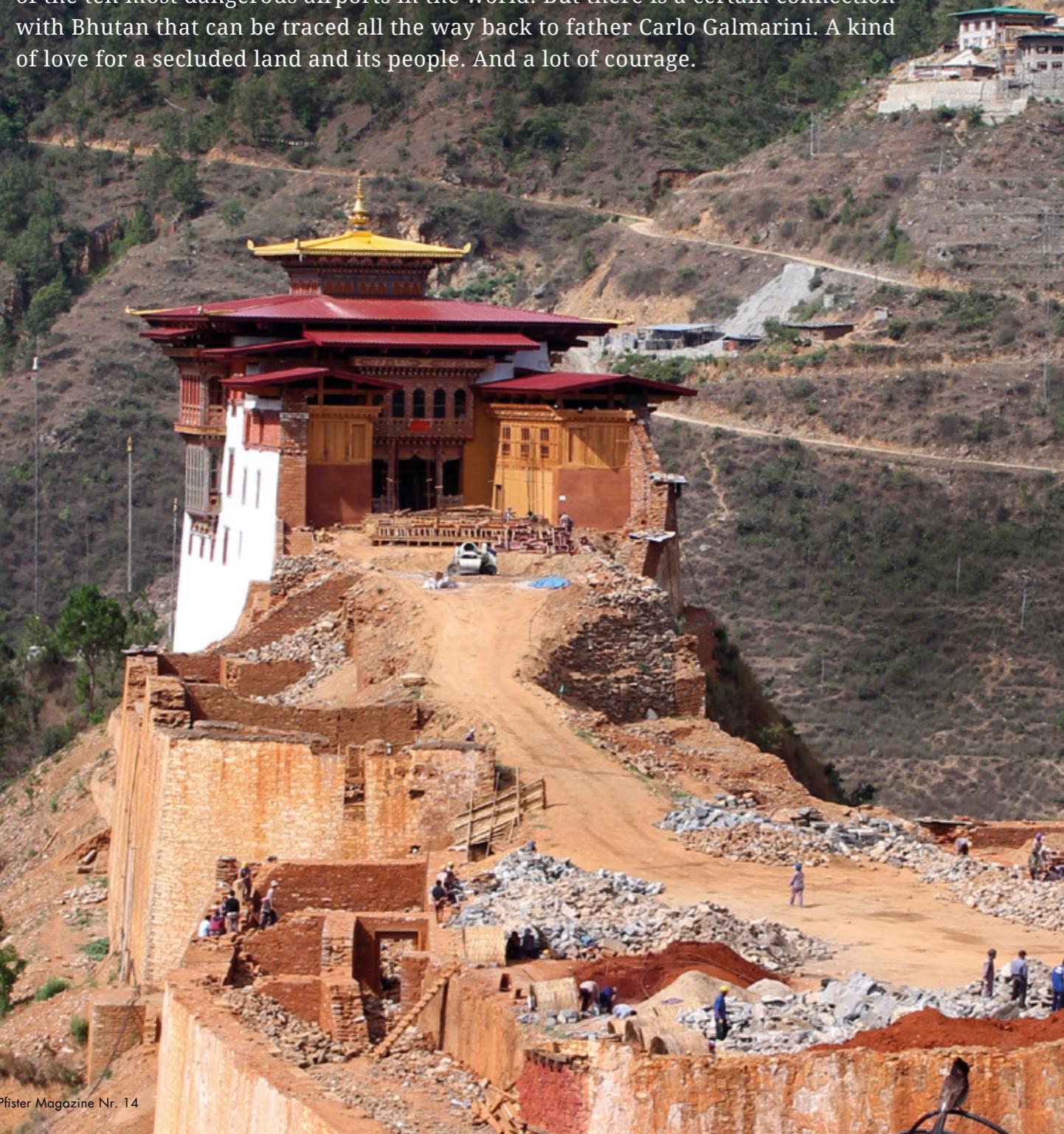
The Swiss construction engineer Andreas Galmarini assists in the reconstruction of a historical building in Bhutan. For the photo session he decided to wear the Gho, the traditional clothing of Bhutanese men. Jigme Choden, a construction engineer from the Bhutanese organisation for the preservation of historical buildings, who is wearing the traditional Kira in the picture, has been invited by him to do an internship in Switzerland.



Two steel plates add pretension to the insulation mats, which will protect the monument's tower from earthquakes. As soon as the four stories of the tower have been erected, the pretension will be released.

Engineering, Passion and Love for People

They spontaneously decided to pack their bags: In February 2015, Andreas and Nathalie Galmarini travel to Bhutan for half a year with their three little children. The Himalayan state offers neither trains nor a motorway system – not even a single light signal. The international airport is located between 5000-metre-high summits and can only be reached during daylight and at clear visibility. It is one of the ten most dangerous airports in the world. But there is a certain connection with Bhutan that can be traced all the way back to father Carlo Galmarini. A kind of love for a secluded land and its people. And a lot of courage.



First There Was a Wooden Bridge

After a violent storm had flushed away an important wooden bridge in Bhutan, father Carlo Galmarini was contacted by a relief organisation around ten years ago – and immediately began the planning process: He increased the span of the bridge from 35 to 55 metres in case that the river might begin to swell again. He also designed the bridge in accordance with modern state of the art engineering practices, without changing its original appearance. The current king was one of the first people to walk across the bridge for his coronation on 6 November 2008. The bridge leads to one of Bhutan's most significant monuments: The Punakha Dzong.

Kindergarten in Thimphu

Back to now: Andreas and Nathalie Galmarini live in Bhutan's capital city Thimphu, with around 100,000 inhabitants the biggest and busiest place in the country. Their six-year-old daughter and their four-year-old son go to kindergarten, the three-year-old youngest son visits a day nursery – without understanding a single word at first. Bhutan's official language is Dzongkha, but most people can also speak English. Andreas Galmarini contributes actively to the preservation of his-

torical structures. He supervises the reconstruction of the Wangdue Phodrang Dzong. A large fire had completely destroyed it – more on this in the main text.

Vision for an Entire Region

Just like his father, Andreas Galmarini combines the traditional architecture of Bhutan with today's methods and continues to be approached for guidance by the "Division for Conservation of Heritage Sites" (DCHS) for new projects. Furthermore, he wants to tackle a much bigger task, "the realisation of a vision", as he calls it: In collaboration with the DCHS, he wants to build a laboratory at the University in Thimphu in order to conduct large-scale earthquake-related tests with stone wall structures. The research results, for which he also requires international support, could be an immense benefit for the entire Himalayan region: "Since stone walls are composed of heterogeneous materials, as it is common in the region, they behave differently from homogenous building materials", explains Andreas Galmarini. "In addition, the people of Bhutan and other Himalayan countries build with clay, and not with cement mortar. This might increase flexibility, however, clay is much less firm than modern materials, which makes

it difficult to predict earthquake resistance." This is where research is needed, because "if you want to preserve the traditional construction techniques, then you have to be able to teach the population how to build traditional houses in an earthquake-proof way".

The Transfer of Knowledge

Andreas Galmarini said it quite clearly: "We want to help and foster." This includes a personal transfer of knowledge. The engineering company WaltGalmarini has invited the young construction engineer Jigme Choden of the DCHS, the state-run organisation for the preservation of historical buildings, to do a four-month internship in Switzerland. The Swiss architect Fritz Baumgartner, who has been living in Bhutan for years, is passing on his knowledge at the construction site of the Wangdue Phodrang Dzong.

The 36-year-old king of Bhutan, Jigme Khesar Namgyel Wangchuck, personally met Andreas Galmarini: In an audience, he explained how the tower of the Wangdue Phodrang Dzong will be mounted in order to be resistant to all types of tremors. The king thanked him and approved the implementation of the concept.



The historical monument of Wangdue Phodrang should, also thanks to the support from Andreas Galmarini, be restored by 2018. Then, Buddhist festivals and dances will be able to take place again as they do in other places in Bhutan.