

The Tsujunkyo Bridge: a Masterpiece of Early-Modern Stone Bridge Architecture



The Tsujunkyo Bridge is the only arched stone aqueduct bridge equipped with a water discharge function.

The Tsujunkyo Bridge is one of the largest arched aqueduct bridges in Japan. It is also known as “Rainbow Bridge” because of the magnificent water flow discharged from the center of the bridge. The bridge was designated as a National Treasure in September of this year. We interviewed an official of Yamato Town, Kumamoto Prefecture, about the bridge’s appeal.

(Text: Morohashi Kumiko)

Yamato Town spreads out in the foothills of Mount Aso in Kumamoto Prefecture, central Kyushu, Japan has a famous stone bridge. The arched stone bridge that extends to the Shiraito Plateau, which is surrounded on three sides by deep valleys, is the Tsujunkyo Bridge. The function of the bridge is to convey water from the Sasahara River to the Shiraito Plateau. It is a truly magnificent structure: the aqueduct is about 119 meters long, while the bridge itself is about 78 meters long, 6.6 meters wide and 21.3 meters high, and the radius of the arch is about 28.1 meters.

It is an aqueduct bridge originally built as part of an agricultural irrigation channel in 1854.

“At that time, the Shiraito Plateau did not have a stable water supply system for agriculture due to its topographical constraints, so it was suitable only for low-productivity farming that used spring water. The local government of the time, led by Futa Yasunosuke, *So-joya* (or *So-shoya*),¹ the chief of the Yabe area, built the Tsujunkyo Bridge to help the local people who suffered from water shortage. Futa was a prominent figure in the Yabe area. In addition to the Tsujunkyo Bridge, he built many canals and stone bridges, and a bronze statue of him stands near the bridge.”

Built as an aqueduct for water supply, the stone bridge features an ingenious structure that uses the difference in elevation to channel water through three



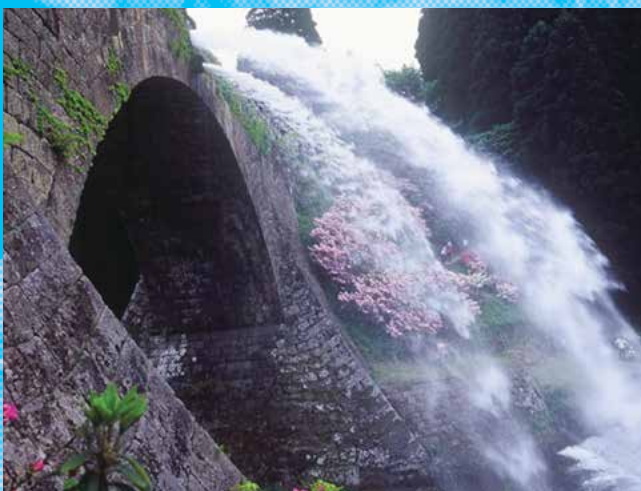
Water is discharged from the center of the Tsujun Bridge at scheduled times throughout the year.



In mid-June, Otaue-sai (“Rice Planting Festival”) is conducted in the rice paddies below the Tsujunkyo Bridge to pray for rain and a bountiful harvest.


pipes installed in the upper part of the bridge.

“The Tsujunkyo Bridge’s water pipes, which are called *fukiage toi* (“push up pipes”), utilize the approximately two-meter difference in elevation between the north channel intake and the south outlet to push water up with great force to the Shiraito Plateau, which is higher than the bridge. In order to make the pipes strong enough to withstand the force of the surging water, *shikkui*² is applied to the joints of the stone pipes. The push up pipes are made of stone and are extremely heavy. To make sure that the structure would bear the weight of the pipes while maintaining stability and boosting earthquake resistance, the builders adopted a variety of creative methods, such as the technique for *saya ishigaki* stonewalls³ modeled after the walls of the Kumamoto Castle. Water outlets are located on both sides of the center of the bridge (two upstream and one downstream). Usually, they are closed with plugs, but are occasionally opened to discharge water. The purpose of the discharge is to flush out sediments (earth and sand) and debris that have accumulated in the water pipes, a function unique to the Tsujunkyo Bridge. Ordinary aqueducts utilize the natural flow of water, so the water is not pushed up, but the Tsujunkyo Bridge uses water pressure to push the water up to the bridge, so when the plugs are removed, the water gushes out in powerful streams.”



Water is dynamically discharged from three outlets.

With its inverted siphon⁴ push up pipes made of highly-durable stone canals, and the use of traditional masonry techniques, this bridge is truly a masterpiece of early-modern stone bridge architecture. However, it was severely damaged by the Kumamoto earthquake in April 2016 and the heavy rains in 2018, and has undergone a series of restoration works.

“The Kumamoto earthquake caused damage to the *shikkui* of the water pipes, resulting in water leakage. Later, a part of the stone wall collapsed when it was exposed to the heavy rains. Due to the restoration work required to repair these damages, the water discharge was suspended, but we were able to resume it in July 2020. The occasions of water discharge increases from September onward each year. So please check the website for the dates on which water is discharged, we will invite many visitors to come and see the Tsujunkyo Bridge.” 

1. A position similar to that of the mayor of a town today.
2. *Shikkui* (a type of Japanese plaster) is a proprietary mixture made by combining slaked lime as the main ingredient with aggregate, hemp, seaweed, and other organic materials. It is known under the Japanese name *shikkui* even in English-speaking countries. The *shikkui* used in the Tsujunkyo Bridge is a mixture of clay, sand, slaked lime, salt and pine needle juice, which is made by boiling pine needles and branches.
3. The term “*saya ishigaki*” (lit. “sheath stone wall”) refers to a stone wall which slopes upward in a concave curve. Such walls were built using the technique of the *ano* (castle builders), changing the angle of the slope at each height interval, so that the slope is gentle at the bottom and becomes steeper and steeper towards the top.
4. An inverted siphon is a conduit structure installed in a section of an open channel. It is called an inverted siphon not because of its hydraulic siphon effect, but because of its shape. It is used when a waterway crosses a river. Both sides of the inverted siphon have free water surfaces, and the difference in water levels creates a flow.



The top of the bridge is also open for visitors to enjoy the view.