Discover the Hidden Beauty of Hāna Bridges

Unabridged article by Jean Mardfin (photos by Ward Mardfin unless otherwise indicated)

The bridges of Hāna are a series of little bridges that date from 1908. These bridges span rivers, streams, gulches, and ponds. While they lack the grand design and super structure of a Golden Gate, Sydney Harbor, or Brooklyn bridge, the bridges on the Millennium Trail to Hāna made possible, in the 20th century, the

opening of one of the most rural areas of the island of Maui. With the completion of the Hana bridges and the major part of the Hana belt road in 1926, the villages of Hāna, Nāhiku, Ke'anae, Huelo, and Kailua, were finally connected by land. After 1937 Kaupō was connected by bridges to Kīpahulu. This road system meant one did not have to travel by steam boat from Kahului to Nāhiku landing to visit someone in a nearby encampment and one did not have to board a ferry at Kīpahulu landing or Kaupō (Mokulau) landing to see a doctor in Wailuku. If you visit these villages today only the remnants can be seen of what was the "landing" at Ke'anae, Nāhiku, Kapueokahi (Hāna Bay), Hāmoa, Kīpahulu, Kaupō, and all the places along the southeast shoreline. In those early days, what bridges existed were only cleared paths across stream



Millennium Trail Marker mm 0 (Geoff Moore Photo)

beds, and timber crossings, if the configuration of the stream bed made a path impossible. All of these attempts to provide safe passage were subject to being washed away at the next heavy rainstorm. Maintenance of these bridges was time consuming and expensive. People travelled between these villages in the early 1900s by sea or by horse or horse drawn carts, mules, or by walking – modes of transport that would disappear with the opening of the road. With the concrete bridges of the early 1900s travel became quicker, more comfortable, and eventually motorized. This article uses the details of bridge construction information from Table 2 and Glossary of Terms in the *Hāna Bridges Historic Preservation Plan* (*Plan*) to provide insight into what can be found in the design and construction of these concrete bridges. Any errors in interpretation and identification are the author's. The 1990 *Plan* described ten character defining features of eighteen stream bridges, including date of construction, the structural system of each bridge, kind of abutment, support, approach guardrails and so forth. The bridges along the southbound route (from Hāna town towards Kaupō) are the responsibility of the County of Maui while the bridges along the northbound route (from Hāna town towards Wailuku) are maintained by the State of Hawai'i. Mile markers (mm) begin at zero where Kaupakulua turns off Hāna Highway and the numbers increase in the Hāna direction until just before Pa'ani Mai Park where there is mm 34. After Hāna town going southward, mm 51 (just past Mo'omo'oiki Bridge) begins the countdown towards Kaupō and Kahikinui. Hāna District ends with mm 21 at the far side of Kahikinui and about 6 miles before 'Ulupalakua. In general southbound bridges have names visible on the bridge but the northbound bridges, while they



used to have signs, no longer do. Sometimes, but not always, the name of a bridge is taken from the stream below it and, in at least one case, there are two names for the same bridge: Punalau (used by local people) or Kōlea (used on the DOT map) near mm 13. The date can be found either incised, or in raised letters, or painted on a bridge on the outer side of the down-stream parapet, or on one or both approach pier ends.

'Ohe'o: example of a bridge with name showing



Punalau or Kōlea



Papahawahawa reversed date on outer slab

One must wonder at the inspiration for the impression of a mirror image of "AD 1913" above at Papahawahawa Stream bridge (mm 46). To see this impression, one must be off the road

and this distinctive feature may not be there much longer as the bridge is currently being replaced.

The following descriptions portray what is visible from the top of the road (superstructure) and continues to the areas under the bridge (understructure).

Many Hāna bridges have a reinforced concrete deck described in the *Plan* as a girder, slab and tee-beam bridge and are short single-span bridges. Walls on either side of the stream supporting the bridge deck are called the abutment. Retaining walls extending laterally from the bridge abutment that stabilize the banks of the stream are wing walls.

Reinforced concrete is the primary building material, with stream abutments and retaining walls made of concrete rubble masonry (CRM). One hundred years

ago "mortared native rock" of which CRM consists, was the material of choice and availability. A careful examination of many bridges and surrounding areas shows how CRM was utilized in streams for water catchment, water diversion ditches, and other uses. At Hanawī (mm 23-24) a support column on the makai streamside was probably for a water flume and at Kopili'ula (mm 21-22) remnants of gear mechanisms suggest another water

diversion structure. Ditches are visible near



Water diversion at Kopili'ula



CRM support structure at Hanawī

the roadway at mm 22 (see photo on next page) and at other locations if one parks the car and looks over bridges.

Above the deck of a bridge is the bridge railing or parapet. Many singlespan bridge railings share a common design of rectangular posts supporting a top railing, with spaces between the posts. Twenty-nine foot long West Waioni bridge built in 1920 near mm 27 (see second photo on next page) has approach guardrails of CRM and railings of short

vertical posts. At the ends of the railings of the bridge are square caps, with flat tops. On other bridges can be found caps with peaked tops. On longer bridges of similar style additional square caps may be found approximately in the middle of the



Open ditch and tunnel

below).

The railings contain steel reinforcement bars within the concrete. In a few spots because of



If the rails are not open the parapet may be a solid slab. These solid slabs may have a top cap, either flat or peaked, that runs the length of the slab, (Puohokamoa mm 11 with a peaked cap see photo



Puohokamoa bridge

West Waioni bridge

age or encounters with cars, some railings reveal efflorescence from water penetration that accelerated rusting, appearing like open wounds. (see Kea'aiki bridge mm 27 see below)

When these railings have been whitewashed, visibility is improved for the nighttime driver. (see West Waioni bridge above)

Pu'uhaoa Bridge (mm 43-44)

has an open balustrade with ornamental openings of triangle points at the top and

bottom (see top photo on next page). The rail caps on its end piers (with incised panels) are square and larger than usual, thus overhanging the pier post. 'Ohe'o Gulch bridge also has a similar decorative open balustrade appearance (see photo on page 2).

A few bridge railings have neither solid flush face concrete nor open pier parapets. These bridges may have short rock walls of CRM connected by pipes painted white that serve as a kind of guardrail. (see Nuanualoa



Kea'aiki bridge

bridge mm 36 near Kaupō on next page) At mm 9, Punalu'u, is a collection of cubes about 18 inches square that rest along both makai and mauka sides of the road above



Pu'uhaoa bridge showing open balustrade, ornamental openings, square rail caps



Nuanualoa bridge

Koukou'ai (mm 40 in Kīpahulu) and Pukuilua (mm 47) are examples. However the understructure of these bridges that said driver would see may be worth the drop. a culvert, but the cubes lack the connecting pipes. No other "structure" like these unconnected cubes were found along Hāna Highway (see photo below).

Occasionally a bridge has a raised edge of a few inches off the sides of the deck where a careless driver could easily sail over and fall 10 or more feet.



Punalu'u "cubes"

The bridge deck, guardrails, and parapet are easily visible on the drive, but to examine the understructure of a bridge one must park the car at a safe turnoff and walk a short distance. Single-span bridges have no central support—only girders that are horizontal beams resting on the abutments. An abutment and wing walls



Koukou'ai bridge from road



Pukuilua bridge from road



Koukou'ai bridge from underneath

Pukuilua bridge from underneath

may be made of well placed local rocks. The single-span bridge at Pukuilua (see photo above) reflect an earlier time when hand worked rock wall building as part of the under structure was a functional art.

One of the oldest bridges, Mokulehua, dated 1908 is a 48-foot concrete slab supported by piers rising out of the stream bed near mm 28 north of Nāhiku Marketplace (see photo below). Piers can be rectangular columns with square corners (some broader at the base than the top as with Mokulehua) or columns with



Mokulehua bridge showing pier supports

curved faces. Still others are cylindrical tubes or pipes under the road bed with a diameter of over 6 feet. Lelekea (mm 39 before Kaupō; see photo below) is an example of a bridge deck resting on this kind of deck support.

Bridges supported by arches are perhaps the most admired and photographed. 'Ohe'o and Hanawī bridges have a single arch support (see photos top of next page).

Another arched support bridge with an 83 foot

arch span is the 108 foot long Waikani bridge (mm 20) which was built in 1926--75 years ago (photo middle of next page).

There are however some bridges with nondescript roadbeds over a lovely arch support structure hidden from pedestrian and driver's view. For example Koukou'ai (see photos pages 5 and 6 on the left) and Hāhālawe (mm 43; photo on next page) deserve a second look. Viewed from the streambed Koukou'ai has a single arch with columns supporting the bridge deck above. It is an unexpected uplifting vision to a swimmer below. Hāhālawe has a carefully



Lelekea bridge showing corrugated cylindrical supports (Geoff Moore Photo)



'Ohe'o bridge from above showing single arch

Hanawī bridge with single arch



Waikani bridge (Geoff Moore Photo)



Hāhālawe bridge showing keystone

made arch with a well placed keystone in the middle of the of the arch support (inside oval on right photo).

Wooden bridges no longer exist on the Hāna Highway, but a few photographs taken by Nick Soon in the first half of the 20^{th} century preserve the flavor of the past. For example, 1911 photos of a wooden truss bridge show the former structure over 'Ohe'o gulch before the current concrete bridge was built in 1916. The photo on the next page at the top left shows it up close while the photo on the right shows it from the lower pools. A color photo by the Hāna Youth Center (on bottom left) shows the bridge today. The lower right shows the then newly built concrete bridge in 1921.



Above: 1911 'Ohe'o wooden truss bridge from road (Nick Soon middle with Iolani schoolmates)



'Ohe'o wooden truss from lower pool

(three b&w photos by Nick Soon)

(color photo below by Hāna Youth Center) Below: 2010 'Ohe'o concrete bridge

1921 'Ohe'o concrete bridge (5 years after 1916 construction)



Another example is the bridge over Manawainui stream ("little Manawainui") that was changed from wood to concrete in 1947-48. Four photos by Nick Soon on the next page preserve this history and the Hāna Youth Center photos of 2010 show how it looks today.





Top two photos on left are the wooden Manawainui stream bridge in 1922 from makai and mauka. The photo above is also 1922 but was originally b&w then colorized by Nick Soon. The third photo on the left was taken in 1948 as Manawainui concrete bridge was under construction.

(all four photos by Nick Soon)

Below: Manawainui stream bridge as it appears today (Hāna Youth Center photos)



Today the bridges on the Hāna Highway provide more than an easy drive connecting residents along the east Maui coast. The historical lesson of the road to Hāna is to remember to appreciate the skills of the engineers and workers who designed and built the Hāna bridges one hundred years ago and hope these structures continue to support the traffic currently traveling over them.