

HONOULIULI BRIDGE
(Honouliuli Stream Bridge)
Farrington Highway and Honouliuli Stream
Ewa Beach Vicinity
Honolulu County
Hawaii

HAER No. HI-99

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
U.S. Department of the Interior
National Park Service
Oakland, California

HISTORIC AMERICAN ENGINEERING RECORD

INDEX TO PHOTOGRAPHS

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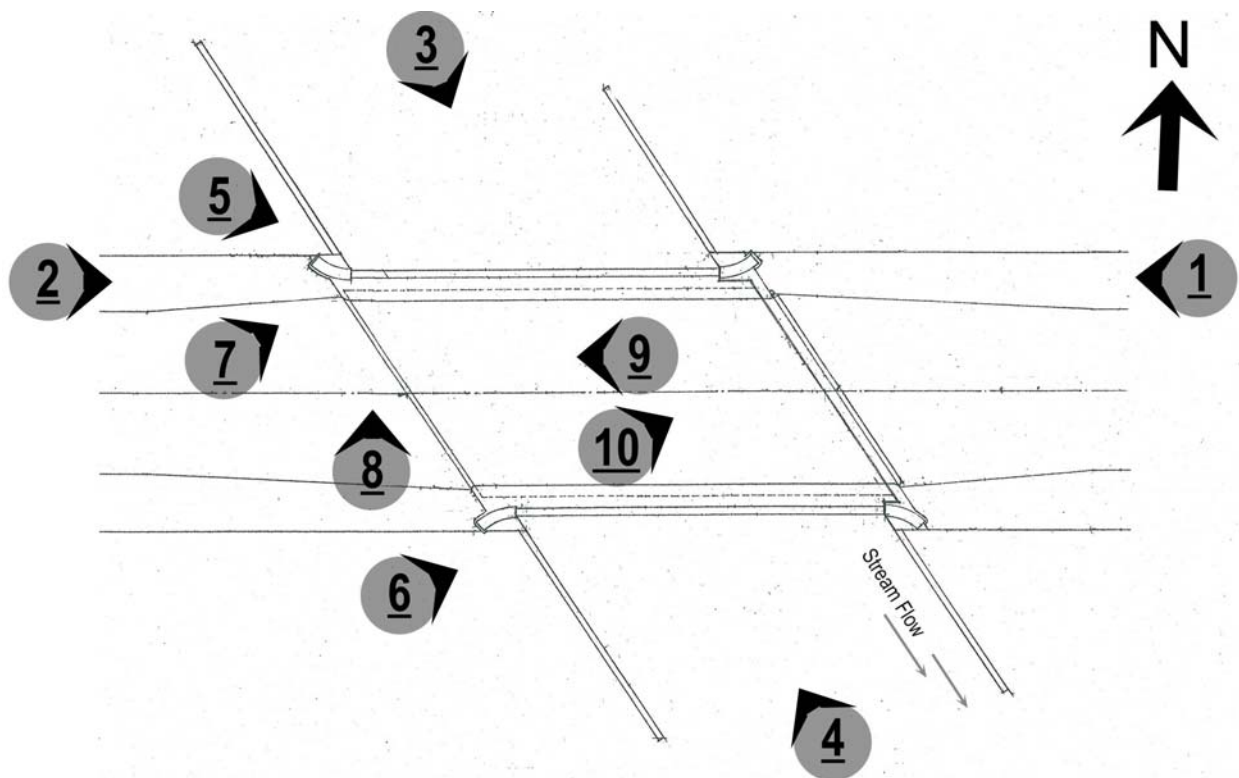
David Franzen, Photographer

May 2012

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PHOTO KEY



HISTORIC AMERICAN ENGINEERING RECORD

HONOULIULI BRIDGE (Honouliuli Stream Bridge)

HAER No. HI-99

- Location:** Farrington Highway and Honouliuli Stream
Ewa Beach Vicinity
City and County of Honolulu, Hawaii
U.S.G.S. Topographic map, Ewa Quadrangle 1998 (7.5 minute series)
Universal Transverse Mercator Coordinates NAD 83:
04.600210.2363880
- Present Owner:** City and County of Honolulu
- Present Use:** Vehicular Bridge
- Significance:** The Honouliuli Bridge is a significant resource in the history of Oahu's road transportation system. It is significant at the local level for its contribution to the development of the Farrington Highway segment, an important connector in Oahu's belt road system. The bridge facilitated passage along the highway across the Honouliuli and Waipahu areas, providing a better linkage for the Ewa and Waianae areas in the west to the urban center and main port of Honolulu.
- Historian:** Dee Ruzicka
Mason Architects, Inc.
119 Merchant Street, Suite 501
Honolulu, HI 96813
- Project Information:** This report is part of the documentation for properties identified as adversely affected by the Honolulu Rail Transit Project (H RTP) in the City and County of Honolulu. This documentation was required under Stipulation V.C. (1, 2) of the Honolulu High-Capacity Transit Corridor Project (HHCTCP) Programmatic Agreement (PA), which was signed by the U.S. Department of Transportation's Federal Transit Administration, the Hawaii State Historic Preservation Officer, the United States Navy, and the Advisory Council on Historic Preservation. After consultation with the City and County of Honolulu, the National Park Service, Pacific West Regional Office, in a letter dated June 29, 2011, stipulated the details of the required documentation efforts, including HAER documentation for this and other bridges affected by the H RTP. Archival photographs were taken by David Franzen, Franzen Photography, Kailua, HI. The field work was conducted and the initial report prepared in May 2012.

Part I. Historical Information:

A. Physical History:

1. **Date of construction:** 1939.¹
2. **Engineer:** William R. Bartels, bridge engineer for the Hawaii Territorial Highway Department. He received his education and training in Germany and immigrated to Hawaii in 1932 when he commenced working with the Highway Department; he continued his career there until his retirement in 1958.² During that period he was a prolific designer, responsible for large and sophisticated bridge construction projects in Hawaii, including many tee-beam and rigid-frame concrete bridges. Bartels' name appears on original drawings of the Honouliuli Bridge as the designer. These drawings were completed in February 1938, drawn by C.F. Wagner but designed and checked by Bartels. Louis S. Cain, the Territorial Highway Engineer, approved the drawings.
3. **Builder/ Contractor/ Supplier:** E.E. Black, Contractor³
4. **Original plans and construction:** The Honouliuli Bridge is a single-span, reinforced-concrete tee-beam bridge carrying two lanes of traffic over Honouliuli Stream. The bridge has concrete parapets and end stanchions that were typical for the time of its construction in Hawaii. The parapets are thickly built, with cross-shaped voids. The end stanchions are also thickly built and squat, and are curved (arc) in plan with stepped edges. The underside of the bridge has four longitudinal beams with one transverse beam near the midpoint. The bridge appears as it was originally built, except for the addition of modern steel guardrails, which are attached to all four end stanchions and cover the original year date and name inscriptions.
5. **Alterations and additions:** Steel guardrails were added to the end stanchions at an unknown date. This bridge currently has a National Bridge Inventory Structure Number of 003922001100001.

B. Historical Context:

The Honouliuli Bridge was constructed as part of the Territorial Highway Department's extension of Waianae Road in 1938-1939 under Federal Aid Project (F.A.P.) No. 4-C, which was subtitled "Waipahu Cutoff." The bridge was completed in 1939. Before this project the only connecting road through the area, between Ewa Junction in the east and Waianae Road in the west, was Waipahu Road. This roadway, originally simply called "Government Road," linked Waianae Road with Kamehameha Highway (the main belt road) at Ewa Junction. Waipahu Road (now Waipahu Street) is a winding road through the former plantation village of Waipahu, running generally east-west. Before 1938, its western end had a section that basically ran north-south.

Before, and for decades after annexation, there was no federal funding for roads. During the Republic of Hawaii period (1894-1898), and especially after annexation of Hawaii by the United States in 1898, political and business leaders recognized that the creation of improved belt roads with modern bridges around the perimeter of each island was of great importance to

¹ "Three Major Improvements Are Dedicated at Waipahu," *Honolulu Star Bulletin*. October 30, 1939. p. 16.

² "TH Honors 4 Veteran Employees," *Honolulu Advertiser*, July 1, 1958. From microfiche titled "Bartels" at the University of Hawaii Hamilton Library, Honolulu Newspapers Clippings Morgue.

³ Superintendent of Public Works. *Report to the Governor of the Territory of Hawaii*. (Honolulu: Author) 1940. p.22.

linking each island's communities, and to their economic growth.⁴ Once Congress passed the Hawaii Bill of Rights in 1924, the Territory of Hawaii received federal highway funding in 1925, after years of fighting for such funds. Thus the Territory could more rapidly reach its goal of completing and improving the islands' belt roads. The Territory built the first concrete bridge over Honouliuli Stream in 1927, just south of this 1939 Honouliuli Bridge.⁵ As automobile and truck traffic increased, there was demand for highway improvements.

Much new road construction after World War I in the islands was for military purposes. The Navy opened its two branches of the ordnance storage activity at West Loch and at Luaualei in 1934, plus construction on its Naval Radio Transmitting Station (NRTS) in Luaualei started in 1934. These installations increased traffic from Pearl Harbor to the western side of Oahu; until 1939 trucks had to use the more circuitous route through Waipahu and across the 1927 Honouliuli Bridge. E.E. Black, Ltd. had been the contractor for the NRTS,⁶ before building this bridge and the related highway realignment sections. Construction of this bridge and improved modern road provided a better alternative to original transportation route in this area, which was longer and went up and down more hills.

Several sources noted different costs for the highway work in this area. Newspaper articles stated the Waipahu Cutoff project was expected to cost \$250,000 in 1937.⁷ This total was to be partly funded by Territorial appropriation and with a larger amount of Federal funds, since the cost of "railroad grade crossing elimination" did not have to be matched by the Territory.⁸ The articles also noted: "All curves in the road between [Ewa and Waianae Junctions] will be eliminated"⁹ with "motorists miss[ing] Waipahu entirely when using the cutoff and traffic will be speeded up by elimination of travel through the narrow and winding streets of that community."¹⁰ Before the bids were due from contractors, a newspaper article stated that the highway project (minus the amount for a flood control canal) was expected to cost \$334,700 and begin in July 1938.¹¹ The Waipahu Cutoff project was also known as Federal Aid Project No. 4-C (or F.A.P. 4-C). The portions of the new, straighter highway south of Waipahu that involved crossing railroad tracks were given a different project number – F.A.G.H. 4-C. The Superintendent of Public Works report noted the total cost of those two projects, plus the related Kunia Road project (F.A.P. 16-B), was \$381,238.18.¹² The amount for the Honouliuli bridge was not broken out in any cost estimates or final figures for highway and bridge construction in this general area.

Before this project, the road alignments near Honouliuli Stream were longer, less direct, and with more elevation change. These disadvantages were balanced by the savings derived from crossing the gulch at a narrower point with a shorter (and less expensive) bridge. Waianae

⁴ Heritage Center, School of Architecture, University of Hawaii at Manoa, "State of Hawaii Historic Bridge Inventory and Evaluation," (Honolulu: Hawaii Department of Transportation) 2006. pp. 33-35.

⁵ Hawaii Highway Planning Survey, "Bridge Inventory for the Island of Oahu," (Honolulu: Territorial Highway Department) 1950. [Bridge No. 103].

⁶ Helber, Hastert & Fee, Planners. "O'ahu Integrated Cultural Resources Management Plan." (Prepared for Commander, Navy Region Hawaii) 2008. p. 5-353.

⁷ "Cain Outlines Territory-U.S. Highway Plan," *Honolulu Star Bulletin*, June 29, 1937. p. 1. and "New Highways Will Be Built," *Honolulu Star Bulletin*, December 18, 1937. p. 3.

⁸ "Cain Outlines Territory-U.S. Highway Plan," *Honolulu Star Bulletin*, June 29, 1937. p. 1.

⁹ "New Highways Will Be Built," *Honolulu Star Bulletin*, December 18, 1937. p. 3.

¹⁰ "Waipahu Road Job Bids Are Due June 9th," *Honolulu Star Bulletin*, May 25, 1938. p. 1.

¹¹ Ibid.

¹² Superintendent of Public Works. *Report to the Governor of the Territory of Hawaii*. (Honolulu: Author) 1940. p. 22.

Road (coming from the west) bowed southward at Honouliuli Gulch. Waipahu Road (coming from the east and first bowing southward, then westward) joined Waianae Road, after crossing the gulch, at the "Y" intersection that still exists about ⅓ mile south of the Farrington Highway Honouliuli Bridge. At this intersection the two east-west roads joined, and Fort Weaver Road (now called Old Fort Weaver Road) extended south from this point through the village of Honouliuli. The 1938 Waipahu Cutoff project kept the southernmost segments of the old Waianae and Waipahu Roads (now both are segments of Old Fort Weaver Road), but allowed motorists heading east or west across Honouliuli Gulch to bypass the "Y" intersection via the new bridge and straight section of road. The Honouliuli Bridge was constructed on this straight section between the former curving end segments of Waianae and Waipahu Roads. After the project, any traffic that was bound for Honouliuli village or points south still had to take one of the road segments bowing south to the "Y" junction, but traffic going to or from the west side of the island had a quicker, more direct route over the Honouliuli Bridge.

In 1935, several years before the Honouliuli Bridge and the Waipahu Cutoff were built, the City and County of Honolulu proposed a resolution that would name the section of belt road that traversed Waipahu, Ewa, Waianae, Mokuleia, and Waialua to the Haleiwa-Waialua junction as Farrington Highway. (The portion of the belt road around Kaena Point, which would have connected the Waianae and Mokuleia ends of Farrington Highway, was never built.) The name of the road, which included both new and existing segments, honored former Territorial Governor Wallace R. Farrington (in office 1921-1929), who was "instrumental" in forming plans to complete the belt road on Oahu.¹³ Other sections of the belt road were Kamehameha Highway and Kalanianaʻole Highway. At the dedication of the Waipahu Cutoff on October 29, 1939 the local newspaper referred to it as Farrington Highway and they noted the daily volume of traffic as 2,100 vehicles.¹⁴

The Waipahu Cutoff project included highway construction farther east, running parallel to Waipahu Road, but ¼ to ½ mile *makai* (common Hawaiian term denoting: toward the sea). This provided a more direct route, eliminating the need to travel along Waipahu Road's twisting course through the built-up village of Waipahu. Farrington Highway created a bypass south of Waipahu and greatly improved Oahu's belt road system in this part of the island.

Just a short distance east of the Honouliuli Bridge, in conjunction with the Waipahu Cutoff project, another Federal Aid Project (F.A.P. No. 16-B) extended Kunia Road south from its former end point at Waipahu Road to join the newly constructed road section (Farrington Highway) bypassing Waipahu. This extension of Kunia Road allowed the abandonment of about three-tenths of a mile of old roadway, the north-south section at the western end of Waipahu Road. Much later, after 1983, Kunia Road would be continued south of Farrington Highway as Fort Weaver Road.

Tee-Beam Bridges

Concrete tee-beam bridges are the most common type of remaining pre-World War II bridges in the state of Hawaii.¹⁵ They are a part of the evolution of reinforced-concrete deck bridge technology in Hawaii that began with the first slab bridges around 1908. Often county-designed, these early slab bridges frequently consisted of concrete decks replacing older type superstructures on their original abutments, which were often lava rock and mortar.

¹³ "Farrington Highway to be New Belt Road Name," *Honolulu Star Bulletin*, February 11, 1935. p. 1.

¹⁴ "Three Major Improvements Are Dedicated at Waipahu," *Honolulu Star Bulletin*, October 30, 1939. p. 16.

¹⁵ Heritage Center, "Historic Bridge Inventory," 2006. p. 78.

Design of reinforced-concrete deck bridges progressed rapidly during the first decades of the 20th century. Many of the earliest concrete bridges had been built in the arched form of the Hawaiian kingdom's lava-rock ones. The strength of concrete girder and tee-beam types, and their lower cost, led to their use in locations with short spans, rather than the concrete arched types.

Although the earliest tee-beam bridges in Hawaii date from about 1912, after about 1925 the tee-beam bridge became the preferred choice for bridge construction by the Territorial Highway Department. The pattern of reinforcing steel within their girders was the feature that most distinguished them from other concrete girder bridges. The pattern of reinforcing steel in the girders and deck structurally joins the two.¹⁶ This allows the two components to work together, so that tee-beam bridges can efficiently carry a greater load. This relatively small change over standard girder construction provided an increased carrying capacity, and the tee-beam quickly came into wide use, with examples constructed into the 1950s.

Tee-beam bridges in Hawaii generally had parapets with voids, below a reinforced-concrete rail cap. "Several standard rail patterns [were] used by the Territorial Highway Department, either "Greek-cross", arched, or simple rectangular voids."¹⁷ Earlier masonry (lava rock or concrete) bridges typically had solid railings.

Waipahu

"The town of Waipahu is a child of Oahu Sugar [Company]."¹⁸ The Oahu Sugar Company (OSC) plantation and mill began as a development project of Benjamin F. Dillingham, who had leased land from James Campbell. Dillingham partnered with J. Hackfeld and Company (Paul Isenberg) and with Mark Robinson (who provided land for the mill site) to form the company, which was incorporated in March 1897. The original "Government Road" traversing Waipahu was a much straighter line, but the first OSC manager, August Ahrens, requested rerouting of the road to run south of the mill, which would avoid many crossings of the road by the plantation's rail lines.¹⁹ A land exchange was arranged and Waipahu Road (now Street) basically follows that 1897 alignment through the town.

OSC's first harvest was in 1900. That year the plantation had enough workers to harvest and mill 7,900 tons of raw sugar. In the following years, the population grew with the plantation, which besides field and mill laborers, required tradesmen, supervisors, and engineers. These workers and their families grew the town of Waipahu around the OSC mill. By the late 1920s, Waipahu was sprawled along Waipahu Road, to the east and west of the mill, and a business district had formed south of the mill, with its center at Waipahu Depot Street. Primary residential areas were located *mauka* (common Hawaiian term denoting: inland) of the mill (Japanese Camp) and to the east along Waipahu Road. By the 1930s Waipahu "included second and third generations" that "had grown up on the plantation and considered Waipahu their home."²⁰ In 1940 the town had a population of 6,900.

¹⁶ Parsons Brinkerhoff and Engineering and Industrial Heritage, "A Context for Historic Bridge Types, NCHRP Project 25-25, Task 5." October 2005. p. 3-88.

¹⁷ Heritage Center, "Historic Bridge Inventory," 2006. p. 78.

¹⁸ Michael Mauricio, *Waipahu, Its People and Heritage*, (Waipahu, HI: Waipahu Community Foundation) 1997. p. 59.

¹⁹ Spencer Mason Architects, "Waipahu Street Widening Project, Potentially Historic Properties, " (Prepared for Austin, Tsutsumi & Associates, Inc.). 1990. pp. 1-3.

²⁰ Lani Nedbalek, *Waipahu, A Brief History* (Mililani, HI: Wonder View Press) 1984. p. 27.

The 1939 Waipahu Cutoff, in addition to supplying an alternate road (Farrington Highway) which bypassed the town, provided expanded opportunity for a new business center along its route. Expansion into the space along the road was slow, despite the ca. 1939 flood control project, initiated by the plantation, to divert Waikele Stream directly into Pearl Harbor via a dredged canal. This eliminated the flooding that occurred during heavy rains near Waipahu Depot Street at the convergence of Waikele and Kapakahi Streams.

Growth exploded in the 1960s, with population expanding from 8,353 in 1960 to 22,798 in 1970. This period saw a corresponding increase in building along Farrington Highway. In 1966 the section of the H-1 Freeway between Kunia Road and Makakilo, running *mauka* of Waipahu, was opened, which provided another bypass around the town. Growth in Waipahu continued; the population in 1980 was over 29,000.

Ewa Plantation and Honouliuli

See HABS No. HI-384, Ewa Plantation Company Industrial Center for more information about the Ewa Plantation Company.

At the time of the bridge's construction, the area immediately south of it included an uncultivated area around the small village of Honouliuli, while the rest of the land surrounding the bridge was a large expanse of sugar cane, reaching from the Kunia pineapple lands in the north to the Oahu Railway and Land Company tracks in the south and west past Puu Kapolei. The Ewa Plantation Company leased the sugar cane lands that were south and west of the bridge, with over 9,000 acres planted in 1940. OSC cultivated the lands to the north.

Ewa Plantation was begun ca. 1889 by Benjamin F. Dillingham, who leased the land from James Campbell. Dillingham then subleased a portion to William R. Castle who organized the Ewa Plantation Company. Water for the plantation was supplied by wells. This abundant irrigation supply, along with carefully selected varieties of cane and ample fertilization, allowed large yields, sometimes record-breaking, on the thin soil of the plantation. Because of the relatively level terrain of the plantation, the fluming of cane to the mill was not possible. Cane was transported from field to mill via locomotive, and after about 1947 by truck.

Ewa Plantation built most of their worker's camps near the mill, and much of the high-quality housing other facilities provided by the plantation for their workers were erected at the camps and villages nearest the mill.²¹ The level of quality was possibly due to the cost savings of a compact infrastructure. This plantation had more social benefits, because it was a larger community rather than a series of smaller dispersed ones, and due to enlightened management. As the housing in proximity to the mill (Ewa, Varona, Renton, and Fernandez Villages) grew during the first half of the twentieth century, while historic maps show that the number of houses in the village of Honouliuli declined.

Around the time of the construction of the Honouliuli Bridge, there were still a few dispersed residential camps of Ewa Plantation (Filipino Village, Korean Village, Waimanalo Camp) located away from the main settlements near the mill. The village of Honouliuli was farther from the mill than most of these. Employees of Ewa Plantation living here would have had the advantage of reaching their work fields in less time. A disadvantage was the social isolation of the village. During the first decades of the 1900s, "Ewa Plantation was gradually transformed [from a working farm staffed by transient labor] into a community of employees."²²

²¹ Penny Pagliaro, "Ewa Plantation, An Historical Survey, 1890-1940," N.P. 1987. p. 23 - 26.

²² Penny Pagliaro, "Ewa Plantation," 1987. p. 19.

Part II. Structural/ Design Information:

A. General Statement:

1. **Character:** Honouliuli Bridge exemplifies a typical reinforced-concrete tee-beam bridge constructed in Hawaii during the 1930s and 1940s. Its parapet design with cross-shaped voids and curved-plan end stanchion configuration were also typical of this type of bridge.
2. **Condition of Fabric:** Good.

B. Description:

The asphalt-surfaced roadway of the Honouliuli Bridge is 24' wide and about 55' long. The two sides of the roadway have 3'-0" wide concrete walkways set about 6" higher than the roadway, which form curbs. The two concrete parapets are 2'-10" tall, measured from the walkway surface, and are 47'-5" long between end stanchions, with narrow expansion joints between parapets and stanchions. The parapets have top railings 1'-0" wide and 7" high with 1" x 1½" stepped corners. Below the railing is a series of vertical concrete balustrades 6" wide and 6" thick that are typically spaced at 1'-7" on centers. The thirty-one sections of each parapet that are between the balustrades are slightly thinner (4" thick), and each section was molded with a cross-shaped void. These voids are typical of concrete bridge design in Hawaii during the 1930s and 1940s and are commonly referred to as a Greek-cross shape.²³ Each cross void is 1'-3" high and 8" wide. The base of each parapet, running its length, is 7" high and 10" thick.

The concrete end stanchions are 3'-3" high from the walkway surface, 1'-9" thick, and about 5' long. In plan, they form an arc of a circle spanning about 45 degrees. The stanchion end facing the parapet abuts it squarely and the stanchion curves out away from the roadway, presenting a curving face to the traffic lanes. Each stanchion has 1½" stepped corners, with a top surface that is 1'-3" wide. Along its outer (road-face) curving circumference each measures 5'-5" in length, and along the inner curve, 4'-2" in length. Each stanchion has been altered by an added wedge of concrete on its outer (road-facing) surface that anchors a steel W-beam guardrail. These rails extend along the edges of the roadway at the bridge approaches. Typically, concrete bridges of this type and period have date and name inscriptions on their end stanchions. The concrete wedges cover these inscriptions on the Honouliuli Bridge. The remains of the letters ULI are present on the northwest and the southeast stanchions, to the right of the concrete wedges. The incised block letters are about 3" high, and have been filled with concrete to a level flush with the surface of the stanchion. At each end of the two 6" high walkway curbs that face the oncoming traffic are 8" wide phosphor bronze plates set flush with the concrete walkway surface. These plates cover the tops of 6" diameter "bullseye reflectors" that were originally presented to oncoming traffic by being set into the oncoming face of the curb.²⁴ Added asphalt paving covers the oncoming face of the curbs, so it is not known if the reflectors are still extant under the plates.

Because of the angle at which Farrington Highway crosses the Honouliuli Stream, the footprint of the bridge is a parallelogram. This is most clearly evident from below. The underside of the bridge is board formed concrete, with four longitudinal beams (each approximately 3' high and 1'-4" wide) across the 47'-6" span. These are joined near mid-span by a single transverse concrete beam which crosses the others at a 90-degree angle.

²³ The Heritage Center, "State Of Hawaii, Historic Bridge Inventory and Evaluation," 2006. p. 36.

²⁴ Drawing from database of Hawaii Dept of Transportation Highway, Design Section, Drawing 4449.36, Honouliuli Bridge Sheet 1 of 6, Feb. 1938.

The abutments of the bridge are horizontal board formed concrete with integral wing walls extending about 50' upstream and downstream of each abutment. The top edge of each wing wall angles away from the bridge at a slope of approximately 1:2. The west abutment is 12' high from its top edge to the grade of the streambed. The east abutment is about 20' high; the difference in height is due to the greater depth of the streambed at the east side, where the water channel has scoured down, exposing the toes of the counterforts on the top of the abutment footing. On the original drawings, the west abutment is shown with expansion bearing plates between the top of the abutment and the longitudinal beams. The other abutment is the fixed end of the bridge superstructure. On the outboard sides of the bridge deck, below each parapet, metal pipe hangers carry a single metal pipe of approximately 4" diameter. (Original drawings show two gutters of rubble masonry in the earth near the wing walls at the east end of the bridge that are no longer extant.)

The tee-beam construction of the Honouliuli Bridge²⁵ is the most common remaining type of pre-World War II bridge in Hawaii. Tee-beam bridges are identified by the internal pattern of reinforcing steel and in appearance are virtually indistinguishable from other types of concrete girder bridges. The 47' span of this bridge is moderately long for a tee-beam bridge in Hawaii; several of this type have longer spans.²⁶

C. Site Information:

The bridge is located along a rural section of Farrington Highway about ½ mile west of the edge of the commercial area of Waipahu. In Hawaii roads are not given Tax Map Key (TMK) designations. This bridge lies just north of TMK 9-1-017:016. The rural setting of the bridge remains much as it was at the time of construction. North and west of the bridge, open fields of former sugar cane land extend for several miles; the view to the north is limited by the rising upslope terrain, an embankment, and vegetation. South of the bridge, occupying the area created by the original alignments of Waianae and Waipahu Roads, the campus of Kahi Mohala Behavioral Health Center is partially screened by trees. Farther to the south, and not visible from the bridge, is the small community of Honouliuli.

Part III. Sources of Information:

A. Primary Sources:

Architectural Drawings and Early Views

Original drawings of the Honouliuli Bridge are electronic files (scans) located in the database at State of Hawaii Department of Transportation, Highway Design Section: Project No. 4-C, Waianae Road (Farrington Highway) Waipahu Cutoff. Project ID No. 7101-001, Project File O-10-12, dated 06/09/1938. Drawings of the bridge in the database of the Hawaii State Department of Transportation were created by the Territorial or State Department of Transportation and are considered in the public domain.

Historic Maps and Aerial Photos are located in the collection of the Hawaii State Archives. Other historic maps were found at the Hawaii State Library, Hawaii and Pacific Collection.

Historic maps and aerial photos are located in the collections of the Hawaii State Archives. Aerial photos in the Hawaii State Archives were created under contract for the Hawaii Territorial/State Land Use Bureau and are considered in the public domain.

²⁵ Bethany Thompson, "Historic Bridge Inventory, Island of Oahu," 1983. p. VII-17.

²⁶ Bethany Thompson, "Historic Bridge Inventory," 1983. pp. VII-4, VII-103, VII-107.

B. Secondary Sources:

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Honolulu Star Bulletin.

"Farrington Highway To Be New Belt Road Name." February 11, 1935. p. 1.

"Cain Outlines Territory-U.S. Highway Plan." June 29, 1937. p. 1.

"New Highways Will Be Built." December 18, 1937. p. 3.

"Waipahu Road Jobs Bids Are Due June 9th." May 25, 1938. p. 1.

"Three Major Improvements Dedicated at Waipahu." October 30, 1939. p. 16.

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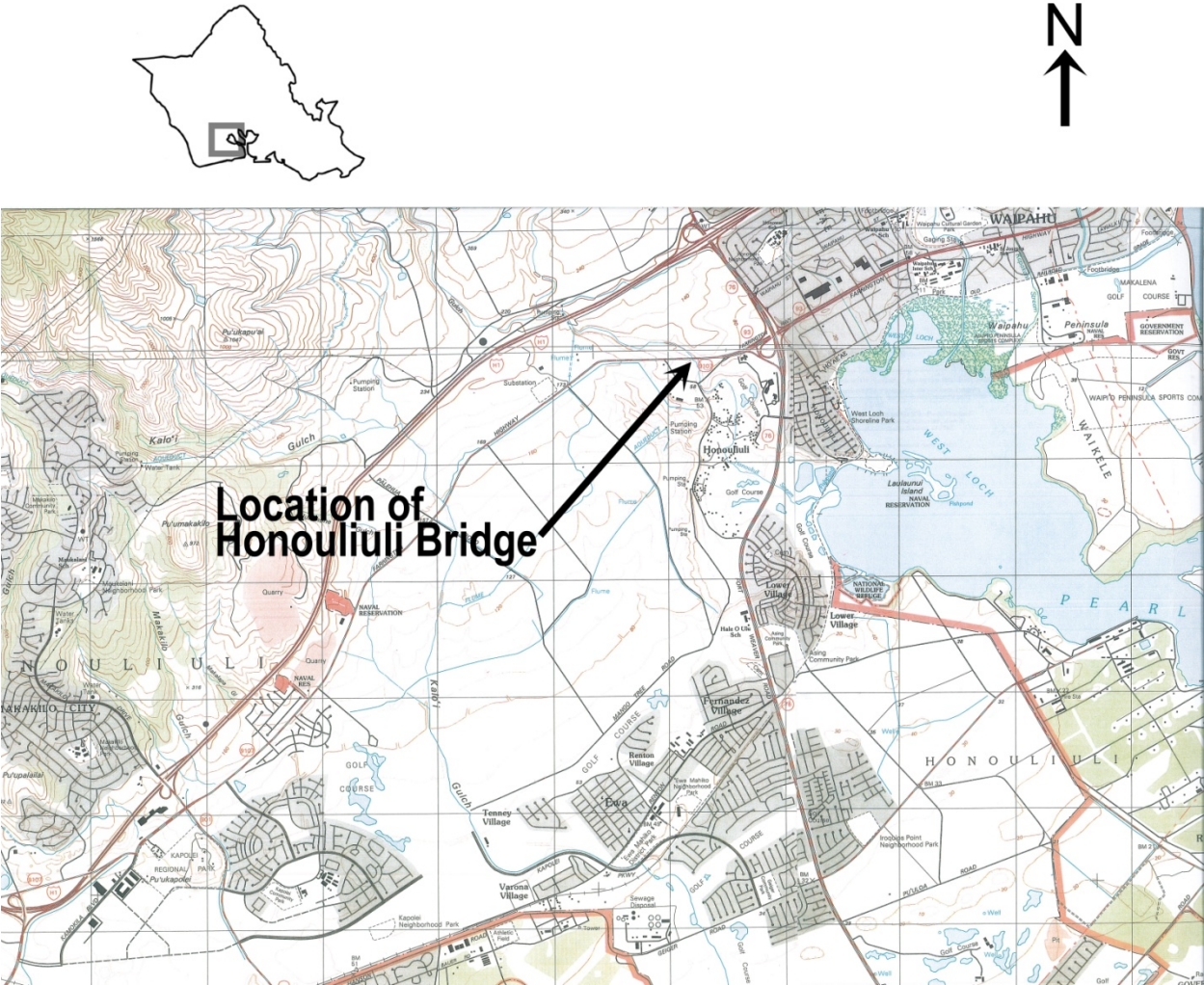
Newspaper articles on W.R. Bartels are available on microfiche at the University of Hawaii at Manoa Hamilton Library, Honolulu Newspapers Clippings Morgue. Various Dates.

C. Likely Sources Not Yet Investigated:

National Archives and Records Administration files for the U.S. Department of Transportation, Federal Highway Administration.

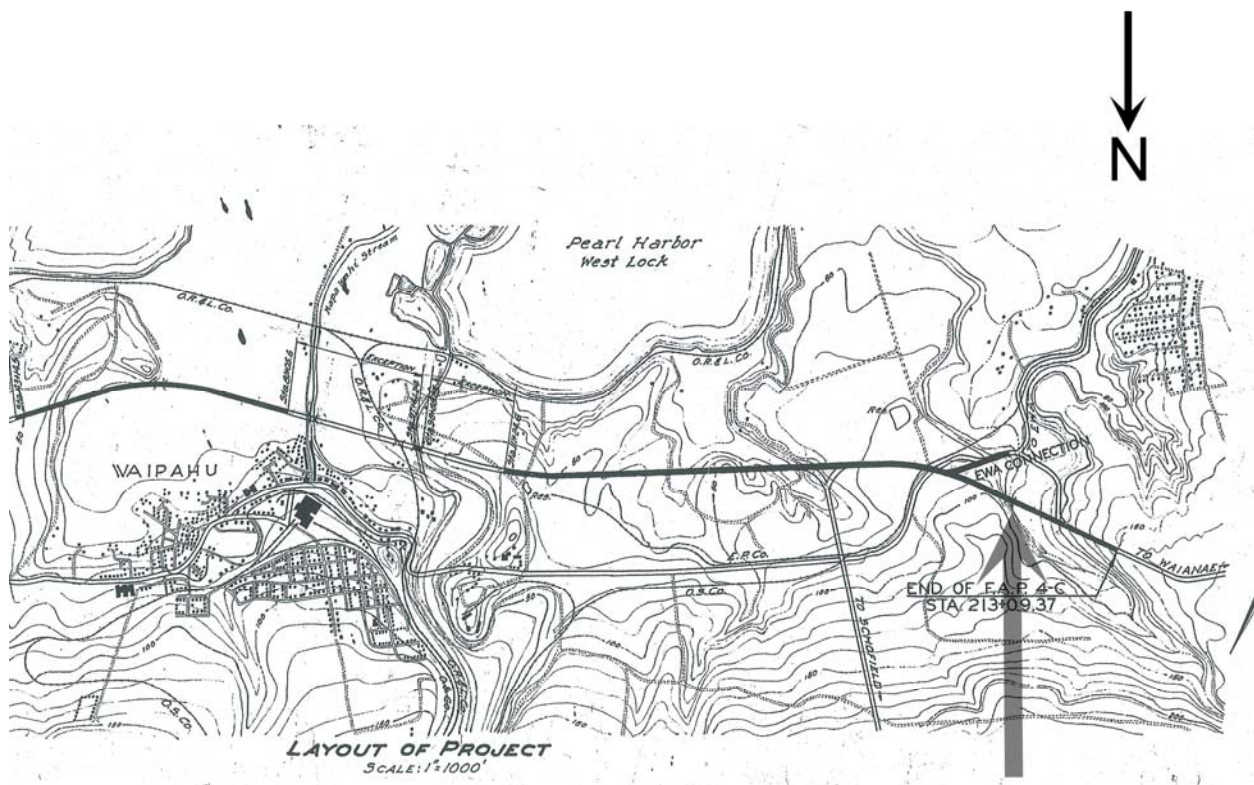
HONOULIULI BRIDGE
(Honouliuli Stream Bridge)
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Location Map



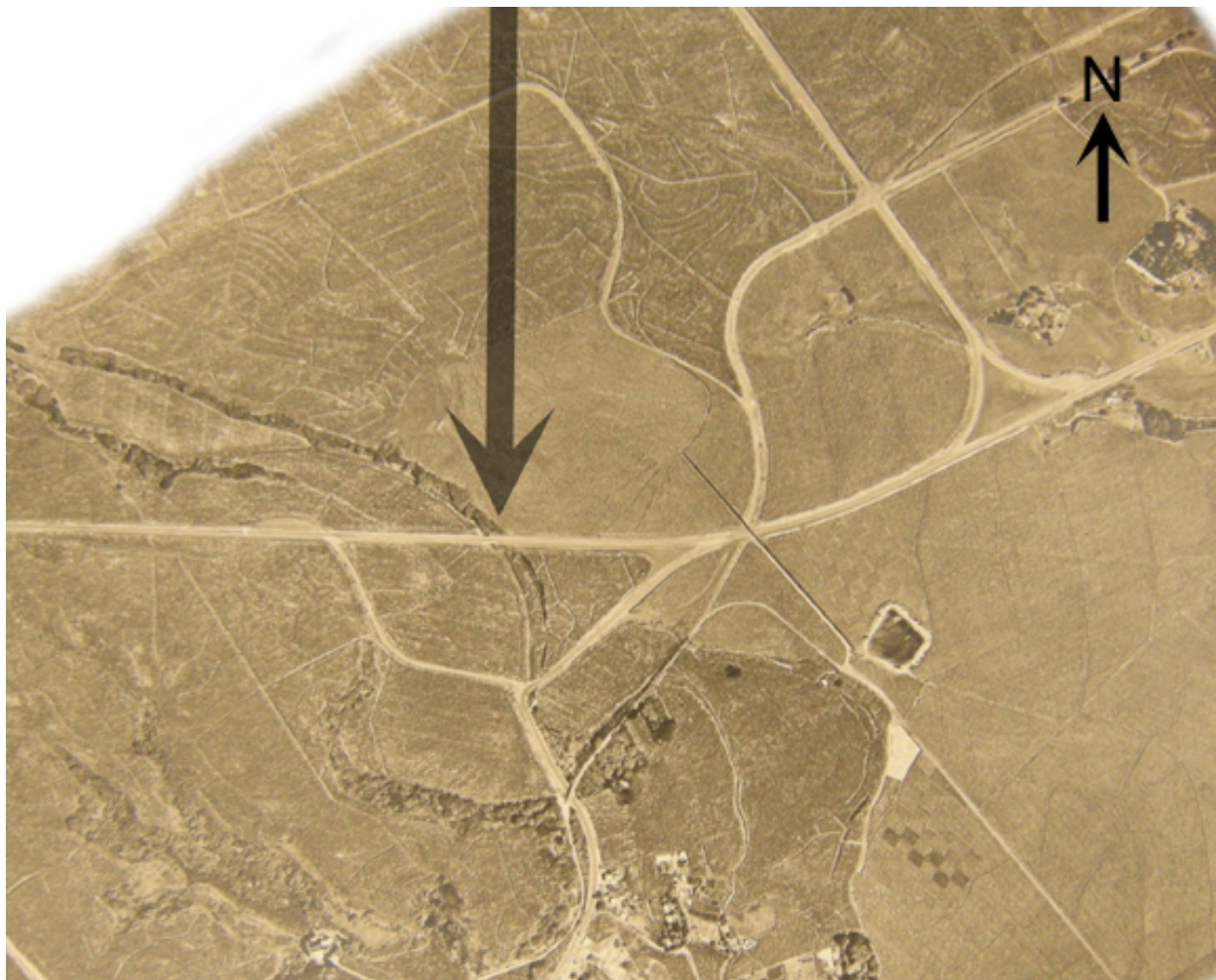
HONOULIULI BRIDGE
(Honouliuli Stream Bridge)
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Portion of the project map for Federal Aid Project 4-C, Waipahu Cutoff. The location of the Honouliuli Bridge is shown by the added arrow. No scale. *Drawing from database of Hawaii Dept of Transportation Highway Design Section, Project ID 7101-001, 06/09/1938.*



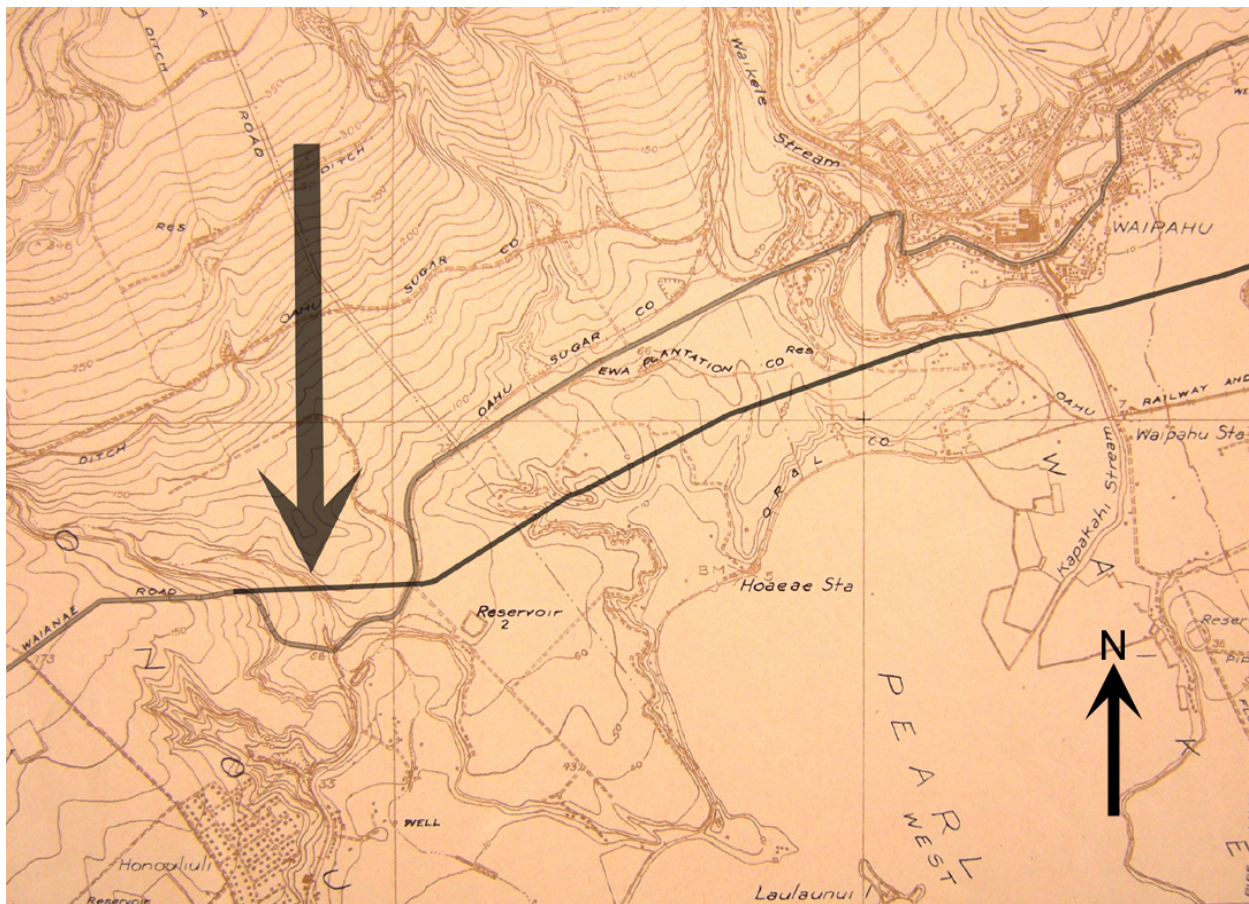
HONOULIULI BRIDGE
(Honouliuli Stream Bridge)
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Portion of aerial photo dated 1939-1941 showing the Honouliuli Bridge shortly after construction (added arrow). No scale. *Hawaii State Archives, Folder PPA-39-3, photo M-7.38 (public domain).*



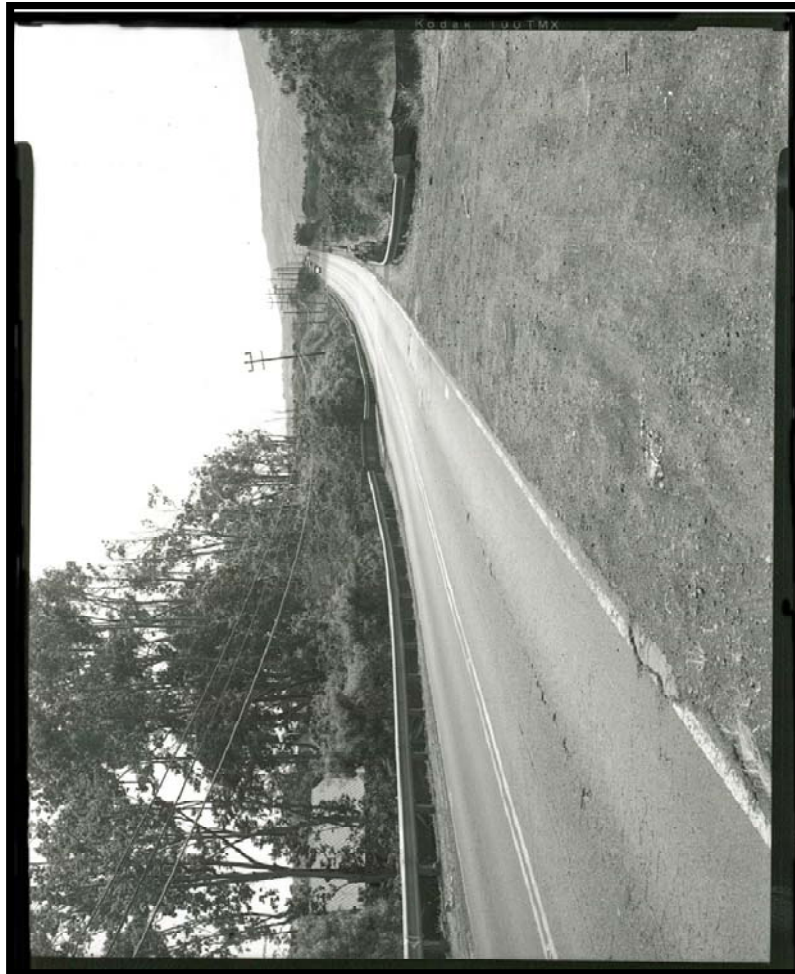
HONOULIULI BRIDGE
(Honouliuli Stream Bridge)
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Portion of 1928 topographic map. The 1928 route from Ewa Junction in the east to Waianae is shown in (added) light gray highlight. A section of the Waipahu cutoff road (Farrington Highway) which improved travel through this area by bypassing Waipahu is shown in (added) dark gray. Note the loop formed by the original alignments of Waianae and Waipahu Roads below the more direct route of the new road. The location of Honouliuli Bridge is marked with added arrow. No scale. U.S. Geological Survey, Waipahu Quadrangle, 1:20,000, 1927.



**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-1



**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-2



**HISTORIC AMERICAN ENGINEERING RECORD
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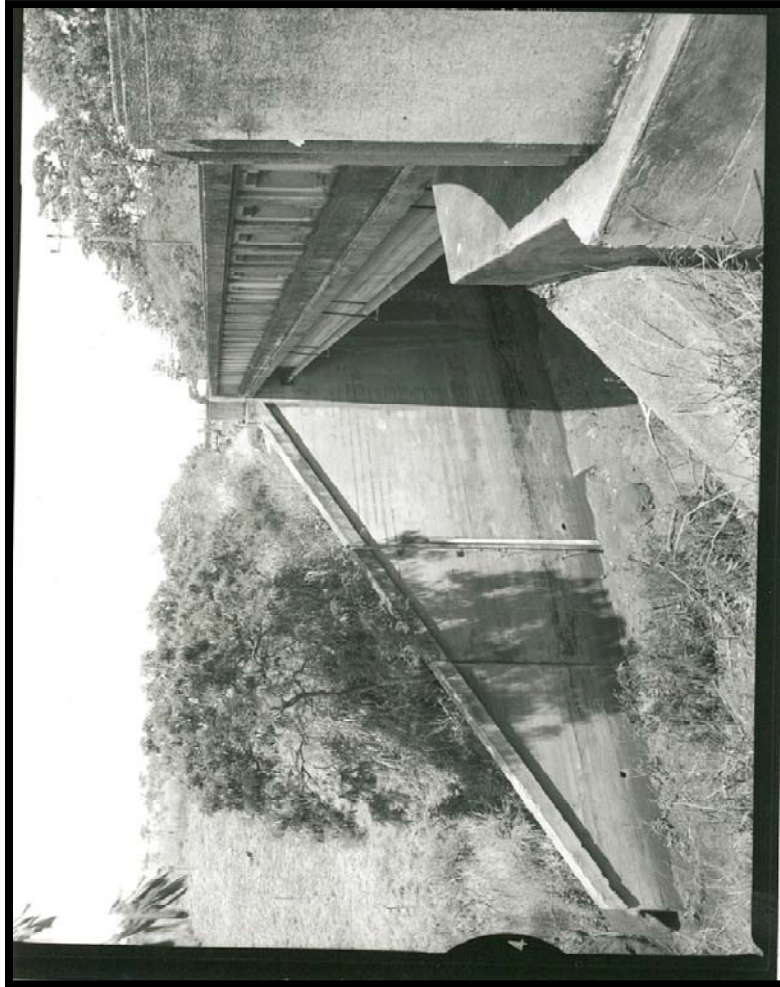
**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-4



**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-5



**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-6



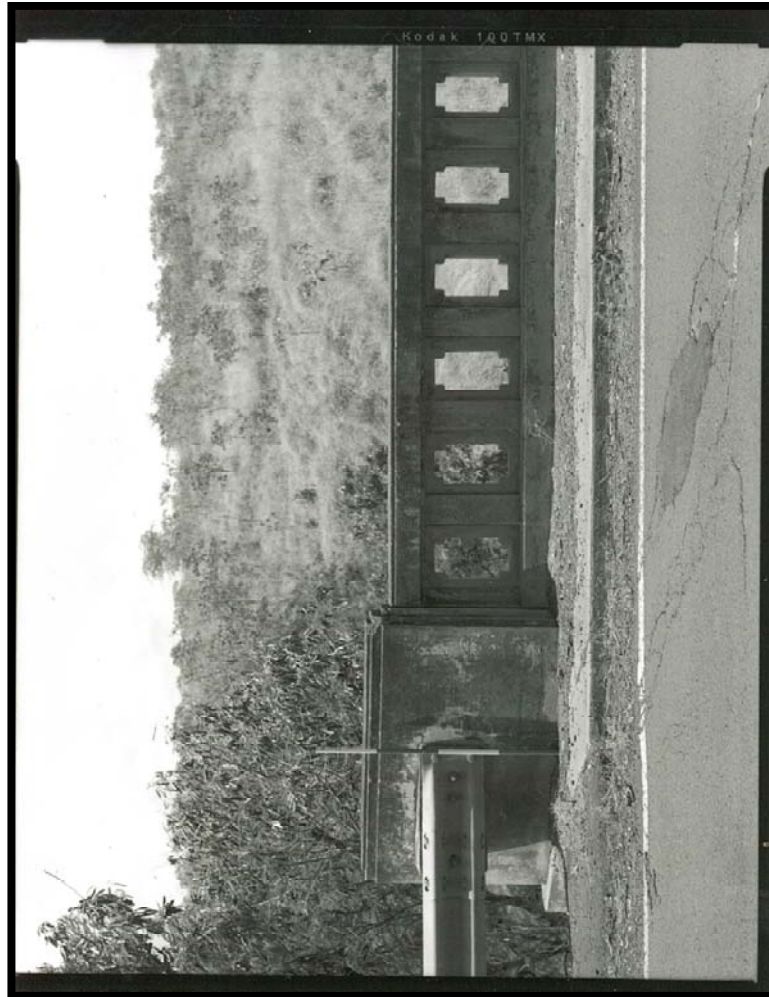
**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-7



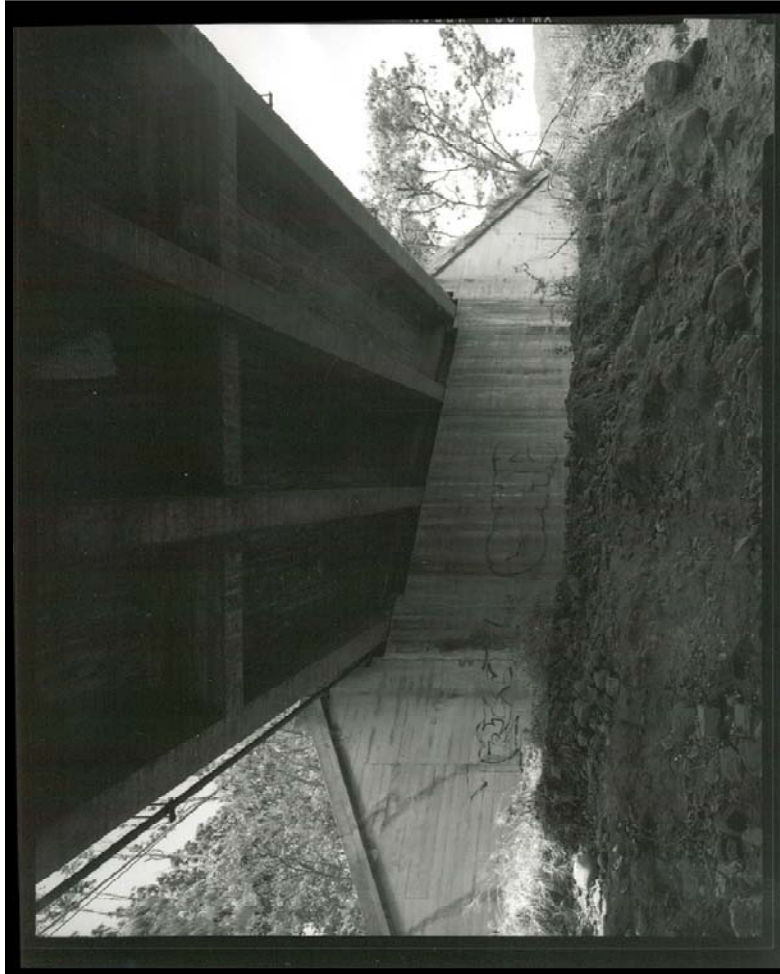
**HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTIONS**

HAER No. HI-99-8



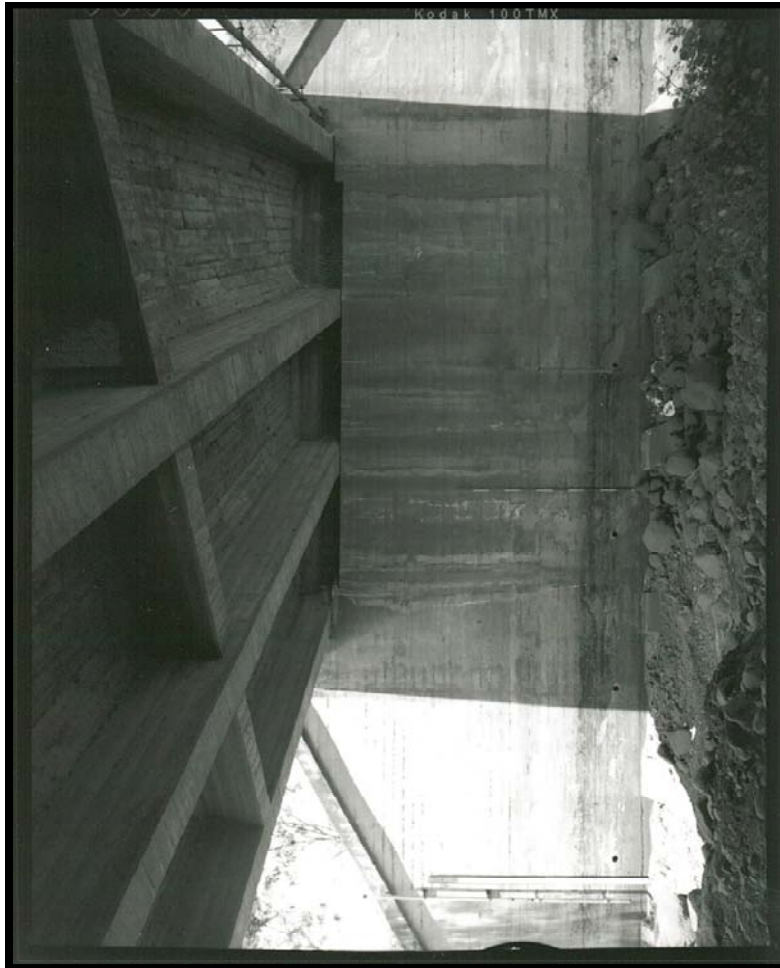
**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-9



**HISTORIC AMERICAN ENGINEERING RECORD
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HAER No. HI-99-10



HAER No. HI-99-11

