

**KALAUAO SPRINGS BRIDGE**  
**(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)**  
**Kamehameha Highway and Kalauao Springs**  
**Aiea**  
**Honolulu County**  
**Hawaii**

**HAER No. HI-116**

**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

KALAUAO SPRINGS BRIDGE  
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Kamehameha Highway at Kalauao Springs  
Aiea  
Honolulu County  
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HAER No. HI-116

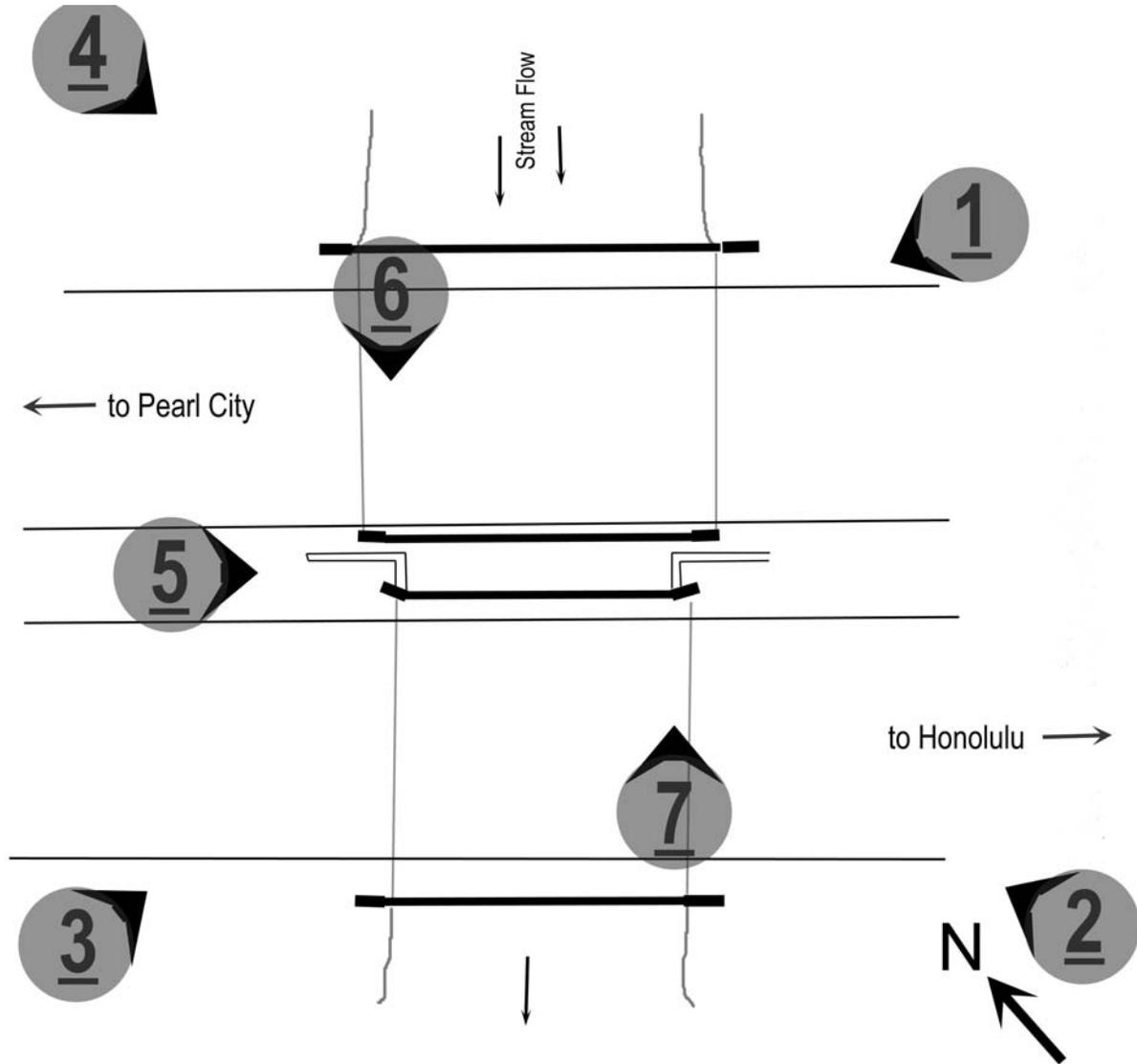
David Franzen, Photographer

May 2012

- HI-116-1 OVERVIEW SHOWING APPROACH TO WESTBOUND BRIDGE. VIEW FACING WEST.
- HI-116-2 OVERVIEW OF EASTERN END OF EASTBOUND BRIDGE. VIEW FACING NORTH.
- HI-116-3 OVERVIEW OF APPROACH TO EASTBOUND BRIDGE. VIEW FACING EAST.
- HI-116-4 OVERVIEW OF WESTBOUND BRIDGE, WITH THE 1945 PARAPET NEAR THE CENTER OF PHOTOGRAPH AND THE 1966 PARAPET ON THE LEFT. VIEW FACING SOUTH.
- HI-116-5 DETAIL SHOWING THE MEDIAN AND THE SPACE BETWEEN THE EASTBOUND BRIDGE'S 1936 PARAPET (RIGHT) AND WESTBOUND BRIDGE'S 1945 PARAPET (LEFT). VIEW FACING EAST-SOUTHEAST.
- HI-116-6 DETAIL OF THE WESTBOUND BRIDGE'S 1945 PARAPET AND STANCHION, WITH SCALE DEVICE [ONE-FOOT INCREMENTS]. VIEW FACING SOUTHWEST.
- HI-116-7 DETAIL OF THE EASTBOUND BRIDGE'S 1936 PARAPET AND STANCHION, WITH SCALE DEVICE [ONE-FOOT INCREMENTS]. VIEW FACING NORTHEAST.
- HI-116-8 "KALAUAO SPRINGS BRIDGE" DRAWING DATED JUNE 1945. *State of Hawaii, Department of Transportation, Highways Division, Design Branch, Drawing 5157.10, June 1945.*

KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116  
Index to Photographs (Page 2)

PHOTO KEY



## HISTORIC AMERICAN ENGINEERING RECORD

### KALAUAO SPRINGS BRIDGE (Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)

HAER No. HI-116

- Location:** Kamehameha Highway and Kalauao Springs  
Aiea  
City and County of Honolulu, Hawaii  
U.S.G.S. Topographic map, Waipahu Quadrangle 1998 (7.5 minute series)  
Universal Transverse Mercator Coordinates NAD 83:  
04.609540.2364800
- Present Owner:** State of Hawaii
- Present Use:** Vehicular Bridges
- Significance:** The Kalauao Springs Bridge is a significant resource in the history of Oahu's road transportation system. It is significant at the local level for its association with the development of this section of Kamehameha Highway and the adjacent Aiea and Pearl City settlements, which evolved, respectively, from a sugarcane plantation and a train-stop "city," into suburbs.
- 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 in May 2012, and the report was prepared in June 2012. The report was finalized in December 2012.

## Part I. Historical Information:

### A. Physical History:

1. **Date of construction:** 1936, 1945, 1966
2. **Engineer:** 1936, unknown. 1945, William R. Bartels. 1966, C.R.Y. / R.K.

1936. No plans were located.

1945. 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.<sup>1</sup> During that period he was a prolific and versatile designer, responsible for large and sophisticated bridge construction projects in Hawaii, including many tee-beam and rigid-frame concrete bridges. He also designed the reinforced-concrete girder bridges (Waimalu Bridge and Kalauao Springs Bridge) and the steel I-beam bridge (Kalauao Stream Bridge) along the Aiea-Waimalu segment of Kamehameha Highway. Bartels' name appears on original drawings of the 1945 Kalauao Springs Bridge as the designer. These drawings were completed in June 1945, drawn by Paul Yamashita but designed and checked by Bartels. B. F. Rush, the Territorial Highway Engineer in 1945, approved the drawings.<sup>2</sup>

1966. C.R.Y. & R.K. are the initials appearing after the note "designed by" in the margins of drawings (C.Y. instead of C.R.Y. on two sheets) for the 1966 widening of Kamehameha Highway that added an extra lane to both the 1936 and the 1945 bridges. These drawings are dated June 1965.<sup>3</sup>

3. **Builder:** 1936 - Walker & Olund, Ltd.<sup>4</sup> 1945 - E. E. Black, Ltd.<sup>5</sup>

4. **Original plans and construction:**

The Kalauao Springs Bridge is comprised of two bridges that both cross the outflow of Kalauao Springs, each of which carries three lanes of Kamehameha Highway traffic in opposite directions, eastward and westward. The original bridge, built in 1936, had two lanes, with one for each direction. This bridge, since 1945, carries the eastbound traffic lanes. It retains a concrete parapet with cross-shaped voids and curved concrete end stanchions. Those two original end stanchions have stepped corner detailing, along with year built (1936) and bridge name inscriptions.

In 1945, the original bridge was augmented by building a second two-lane bridge beside it, *mauka* (common Hawaiian term denoting: inland) of the 1936 one. After this construction, each bridge carried two lanes of traffic in opposite directions. The 1945 bridge conveys the westbound traffic. It retains a concrete parapet with cross-shaped voids and rectangular end stanchions. Although not curved like the 1936 end

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<sup>1</sup> "TH Honors 4 Veteran Employees," *Honolulu Advertiser*, July 1, 1958, article at the University of Hawaii, Hamilton Library, Honolulu Newspapers Clippings Morgue, on microfiche in Biographical section under: Bartels.

<sup>2</sup> State of Hawaii, Department of Transportation, Highways Division, Design Branch, Project No. DA-WR 10 (3), Plans of Three Bridges on Kamehameha Highway, Drawing 5157.1. June 18, 1945.

<sup>3</sup> State of Hawaii, Department of Transportation, Highways Division, Design Branch, FAP No. U-090-I (9), Kalauao Springs Bridge Widening, Drawing 67. June 1965.

<sup>4</sup> "Aiea Highway Link Dedicated," *Honolulu Star Bulletin*, August 25, 1937. p. 6.

<sup>5</sup> Superintendent of Public Works, *Report to the Governor, Territory of Hawaii, for the Year Ending June 30, 1946* [Honolulu: Author] [1946]. p. 26.

stanchions, the remaining 1945 stanchions on the second bridge have similar stepped corner detailing, as well as year built (1945) and bridge name.

In 1966, the State of Hawaii, Department of Transportation widened both the 1936 and 1945 bridges with a third lane in each direction. The new lanes, replacement walkways, and new parapets required demolition of the outboard walkways and parapets of each bridge. The 1966 parapet design features a concrete lower section, topped with two horizontal cylindrical metal rails. The concrete end stanchions are simple rectangular forms with year built (1966) and bridge name inscriptions.

The *makai* (common Hawaiian term denoting: toward the sea) eastbound bridge retains its original *mauka* parapet and end stanchions, dating from 1936. The westbound bridge retains its original *makai* parapet and end stanchions, dating from 1945. These older parapets are adjacent to each other, on the inboard side of both bridges.

Both the eastbound bridge and the westbound bridge are listed as "stringer/ multi-beam or girder" designs, with prestressed concrete, in the National Bridge Inventory (NBI) Database.<sup>6</sup> However, only the 1966 portion of those bridges used prestressed concrete in the structural design; the 1936 and 1945 original bridges were girder designs with cast-in-place concrete.

5. **Alterations and additions:** The bridges have added steel guardrails. They are located along the western approaches to the eastbound bridge, and along the eastern approaches of the westbound bridge, attached to the end stanchions. The 1966 drawings for the Kamehameha Highway widening project do not show these guardrails, so they must have been additions after 1966.

## B. Historical Context:

There are two other related bridges along this segment of Kamehameha Highway, built under the same series of project numbers -- see the Historic American Engineering Record (HAER) reports for Waimalu Bridge (HAER No. HI-115) and Kalauao Stream Bridge (HAER No. HI-117). The original Waimalu Bridge, Kalauao Springs Bridge, and Kalauao Stream Bridge were all initially constructed in 1936-1937; Waimalu Bridge was part of Federal Aid Project (FAP) No. 9-F and the Kalauao Springs and Stream bridges were part of National Recovery Highway (NRH) Project No. NRH-9-C.<sup>7</sup> In 1945, under Hawaii Project No. DA-WR 10 (3), three additional two-lane bridges were built parallel to the original ones, and these new bridges all carried the westbound lanes. The 1966 Kamehameha Highway widening, FAP No. U-090-I (9), included an additional lane on the outboard sides of all six bridges.

The Waimalu Bridge report (HAER No. HI-115) contains general information on the reinforced-concrete girder bridge type. Moreover, it has contextual history on the Honolulu Plantation Company (HPC), which had its mill and main plantation housing areas in Aiea. This report does not repeat that information.

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<sup>6</sup> National Bridge Inventory Database, Kalauao Springs Bridge, on website [nationalbridges.com](http://nationalbridges.com), accessed May 23, 2012. [The eastbound bridge has a NBI Structure Number of 003000990402053 and the westbound bridge has a NBI Structure Number of 003000990402054.]

<sup>7</sup> Superintendent of Public Works, *Report to the Governor, Territory of Hawaii, for the Year Ending June 30, 1936* (Honolulu: New Freedom Press) [1936]. pp. 10 & 11.

## **Kalauao Springs**

The Kalauao Springs were two natural springs of percolating water located directly *mauka* of the Kalauao Springs Bridge. Commercial farming in the area around these springs dates back to at least the late 1800s, when rice was a primary crop. In earlier times, the springs irrigated taro *loi* (common Hawaiian term for flooded terraces). Near the end of the nineteenth century, a tannery was located at the springs. In 1928, Moriichi and Makiyo Sumida began farming assorted wetland produce on a two-acre plot of land at the springs that they leased from Kamehameha Schools/Bishop Estate. At this time, the area of the springs contained many small farms growing similar produce -- bananas, taro, rice, and watercress. Through the ensuing years, the Sumida property grew as they acquired neighboring leases and, by 1950, watercress became the sole crop. The Sumida Farm is still in operation in the area just *mauka* of the Kalauao Springs Bridge.

The Pearl Ridge Shopping Center was developed, ca. 1969, on a portion of the property previously leased to the Sumida family. The lower part of the shopping center is located to the east of the present farm and spring. This development covered one of the springs at Kalauao with pavement, leaving only the present spring actively flowing.<sup>8</sup> This spring currently supplies the water for Sumida Farm watercress cultivation.

## **Kamehameha Highway**

Until 1936 Kamehameha Highway was the only road that provided passage across the *ahupuaa* (common Hawaiian term for land divisions that typically extend from the mountains to the sea) of Kalauao, Waimalu, Waiiau, and Waimano, between the settlements at Aiea and Pearl City. The pre-1936 alignment of this highway ran east-west along a winding route located on firmer ground, but not as level as the well-watered soils closer to Pearl Harbor. Part of Kamehameha Highway's pre-1936 route between Aiea and Pearl City is the present-day alignment of Moanalua Road. Today's section of Moanalua Road between Kaonohi Street and Moanalua Loop is a new straighter alignment; the pre-1936 Kamehameha Highway route followed what are now Kaonohi Street and Moanalua Loop.

Planning for the realignment of Kamehameha Highway, in this area that included the 1936 Kalauao Springs Bridge, had started before 1933, when NRH funds became available; that year, road improvements from Honolulu to Pearl City Junction were on the list for the grants. Within that planned project, the highway section from Honolulu to Aiea had a higher priority, and the remaining section, from Aiea to Pearl City Junction, was to be undertaken "if financially possible."<sup>9</sup> Two years later, this second-priority section beyond Aiea still awaited funding. In 1935, Louis S. Cain, Superintendent of Public Works, submitted a road plan to the U.S. Bureau of Public Roads that included the construction of an "additional unit of Kamehameha Highway beyond Aiea, approximately one mile" that was expected to cost \$148,000.<sup>10</sup> The contract amount reported in March 1937 for construction of the highway from "Aiea through Pearl City" was \$203,000.<sup>11</sup>

On August 24, 1937, the new alignment of Kamehameha Highway between Aiea and Pearl City was dedicated. This new road passed over the three 1936 bridges, crossing Waimalu Stream, Kalauao Springs, and Kalauao Stream. The two lanes of the 1937 Kamehameha Highway are the present-day two inner lanes of the eastbound half of the highway. The construction firm of

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<sup>8</sup> Dee Ruzicka, interview with David and Barbara Sumida, March 9, 2006.

<sup>9</sup> "Hawaii Road Building Projects Selected," *Honolulu Star Bulletin*, June 24, 1933. p. 1.

<sup>10</sup> "Cain Submits Road Plan to U.S. Officials," *Honolulu Star Bulletin*, May 3, 1935. p. 1.

<sup>11</sup> "Cain Reveals Road Scheme for 5 Islands," *Honolulu Star Bulletin*, March 6, 1937. p. 1.

KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116 (Page 5)

Walker & Olund, Ltd. built the section of this 1937 road, between about Kaonohi Street and Aiea, including the Kalauao Springs Bridge.<sup>12</sup> See below for further information about that firm and the funding for the 1936-1937 Aiea-to-Pearl City highway construction.

In 1945 Kamehameha Highway between Aiea and Pearl City was improved by the addition of another two traffic lanes, separated by a median from the 1937 two-lane highway. This allowed the 1945 lanes to be dedicated to westbound traffic and the 1937 lanes to carry eastbound vehicles. This improvement included the 1945 portion of the Kalauao Springs Bridge, which was originally built with matching parapets and stanchions on each side of the new roadway. This 1945 construction was carried out under Hawaii Project No. DA-WR 10 (3).<sup>13</sup> According to the Superintendent of Public Works report after World War II:

During the war years, highway construction activities were limited to the building of new highways, which served as access to military and navy reservations and to those highways, which are part of the strategic network....

As most military and navy reservations are adjacent to and are served by the main public highways, large sums of Federal access money were spent on the latter with the result that all traffic has benefited by these improvements.<sup>14</sup>

The term "access money" was explained in the Superintendent of Public Works 1945 report, as 100% Federal funding for military access roads and "those highways which are part of the strategic network."<sup>15</sup> At the end of the war in August 1945, "all proposed access road projects were dropped by the Federal Government ...; but access road projects under construction were allowed to continue to their completion."<sup>16</sup> This widened part of Kamehameha Highway improved access between the main part of the Pearl Harbor Naval Base and its outlying activities near Pearl City Peninsula, Waipio Peninsula, and further west.

E. E. Black, Ltd., a well-known Hawaii contracting firm, obtained two separate construction contracts in 1945 for the highway improvements near Aiea (between Pearl Harbor installation and outlying Navy activities to the west). The amount of the contract for the two new Kamehameha Highway westbound lanes was \$381,177.40; and their accepted bid for three new bridges (the 1945 Waimalu, Kalauao Springs, and Kalauao Stream bridges) along this corridor was \$139,207.50.<sup>17</sup>

In 1966, the State of Hawaii, Department of Transportation carried out another improvement to this segment of Kamehameha Highway, adding a third lane to both existing two-lane roadways. This was accomplished under FAP No. U-090-I (9). This widening project was in response to numerous complaints about "bumper-to-bumper Kamehameha Highway rush hour traffic past Pearl Harbor," with protests reported at least as early as 1964.<sup>18</sup> The third lane was added on the outer edge (opposite the median) of each roadway. This resulted in the demolition of the

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<sup>12</sup> "Aiea Highway Link Dedicated," *Honolulu Star Bulletin*, August 25, 1937. p. 6.

<sup>13</sup> State of Hawaii, Department of Transportation, Highways Division, Design Branch, Project No. DA-WR 10 (3), Plans of Three Bridges on Kamehameha Highway, Drawing 5157.1. June 18, 1945.

<sup>14</sup> Superintendent of Public Works, *Report to the Governor, Territory of Hawaii, for the Year Ending June 30, 1946* [Honolulu: author] [1946]. p. 17.

<sup>15</sup> *Ibid.*, [1945]. p. 13.

<sup>16</sup> *Ibid.*, [1946]. p. 17.

<sup>17</sup> *Ibid.*, [1946]. p. 26.

<sup>18</sup> "Pearl City Traffic Saddens Police, Too," *Honolulu Star Bulletin*, June 22, 1964. p. 3.

outer parapets, stanchions, and walkways of the 1936 and 1945 bridges and the construction of the extant 1966 replacements of these elements on the outer edges of the new traffic lanes.<sup>19</sup>

Kamehameha Highway in this section, while also important to the military, has always linked the Aiea and Pearl City communities. See the history of Aiea in the report on Waimalu Bridge (HAER No. HI-115) and of Pearl City in the report on Waiawa Bridge (HAER No. HI-101).

### **Original Kamehameha Highway Funding around Kalauao and Construction Difficulties**

The contract from the Territorial Department of Public Works, for the section of Kamehameha Highway that included the Kalauao Springs and Kalauao Stream Bridges, was awarded for \$153,647.87, with most of the cost covered by the federal government, as "U.S. Public Works Project No. NRH-9-C."<sup>20</sup> This type of funding was basically a grant and did not require matching with Territorial money. Due to the Great Depression in the 1930s:

In June 1933, Congress passed the National Industrial Recovery Act (NIRA). The act was designed to help individual states with a variety of programs including new highway construction.... It was also designed to aid the states in providing unemployment relief for the millions out of work. Under the NIRA of 1933, individual states were able to obtain additional funds through grant programs, such as the National Recovery Highway... program, [under which] the United States Bureau of Public Roads stipulated that portions of the funding should be used for roadside landscaping and to develop shore routes and inland tourist lanes.<sup>21</sup>

This section of Kamehameha Highway did run near part of Pearl Harbor's shoreline, but it certainly was not designed to be a tourist route. Rather it was noted that upon its "completion the public will have available an improved highway from Honolulu to the fast growing community of Wahiawa."<sup>22</sup> This was not an easy area for highway construction, due to numerous wetlands in the *ahupuaa* of Kalauao, Waimalu, Waiau, and Waimano. The names of all of those *ahupuaa* contain the word "*wai*" (Hawaiian term for water), except for Kalauao, which means "the multitude [of] clouds."<sup>23</sup> These *ahupuaa*, between the settlements at Aiea and Pearl City, were noted for their extensive irrigated fields in the eighteenth through the early twentieth centuries. Such wetlands were one reason that the original alignment of Kamehameha Highway had been inland, on more topographically varied, but more solid ground.

A newspaper article at the 1937 opening of the "Aiea Highway," as this portion of Kamehameha Highway was called, noted that for the contractors:

A difficult engineering problem was faced in building a durable road bed since the highway skirts Pearl Harbor and in many places passes through former swamp

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<sup>19</sup> State of Hawaii, Department of Transportation, Highways Division, Design Branch, FAP No. U-090-I (9), As Built Plans of Kamehameha Highway Widening, Drawings 1-6 & 58-87. July 22, 1965.

<sup>20</sup> Superintendent of Public Works, *Report to the Governor, Territory of Hawaii, for the Year Ending June 30, 1936* (Honolulu: New Freedom Press) [1936]. p. 10.

<sup>21</sup> Irene Jackson Henry and William Henry, *Historic American Engineering Record, Veterans Memorial Park and Parkway, Muskegon, Michigan* (Eagle, Michigan: Henry & Henry Preservation and Architectural Consultants) July 1996, on website [lcweb2.loc.gov/pnp/habshaer/mi/mi0400/mi0455/](http://lcweb2.loc.gov/pnp/habshaer/mi/mi0400/mi0455/), accessed June 13, 2012.

<sup>22</sup> Superintendent of Public Works, *Report to the Governor, Territory of Hawaii, for the Year Ending June 30, 1937*. (Honolulu: Porter Printing Company, Ltd.) [1937]. p. 22.

<sup>23</sup> Mary Kawena Pukui, Samuel E. Elbert, & Esther T. Mookini, *Place Names of Hawaii* (Honolulu: University of Hawaii Press) 1976. p. 75.

lands.... In constructing the highway, it was necessary to lay a lumber mat of 265,000 board feet before putting in the rock sub-base.<sup>24</sup>

Although part of "Aiea Highway" officially opened for traffic on August 24, 1937, there was a mile-long portion where it was "still necessary to detour through Aiea to the old Kamehameha Highway."<sup>25</sup> Despite the ceremonies "marking an important step in territorial highway development," the roadway surface was, at that date, only loose rocks treated with oil, with a plan that "a macadam finish will be applied within one year."<sup>26</sup>

### **Walker & Olund, Ltd.**

The contracting company that built the Kalauao Springs Bridge and Kalauao Stream Bridge in 1936-1937, along with several miles of connecting highway segments, was the firm of Walker & Olund, Ltd. John Walker, born in Scotland, came to Hawaii about 1884. Around 1900 he founded his own company, under the name John Walker, Contractor, and the firm has continued to this day, currently under the name Walker-Moody Construction Company, Ltd. Alfred E. Olund, who was born in Minnesota and arrived in Hawaii by 1912, started working with Mr. Walker in 1920. In 1924, the firm was called Walker & Olund, Ltd., and it continued until 1940 with that name, despite the 1928 death of John Walker. The business did not get renamed Walker-Moody Construction Company, Ltd. until 1941, although Mr. Olund had left the firm and Mr. Moody had joined it in 1939. Today, Walker-Moody Construction Company's website states that Walker's company "was one of Hawaii's largest and most respected construction firms."<sup>27</sup> Some of the landmark projects that the company completed in its early decades were the Sacred Heart Catholic Church, "the territorial office building, the new Honolulu city hall, Pier 11, the Territorial hospital for the insane at Kaneohe, the concrete work for the great oil tanks at Pearl Harbor naval base, and the magnificent new home of C. Brewer & Co., Ltd."<sup>28</sup>

## **Part II. Structural/ Design Information:**

### **A. General Statement:**

- 1. Character:** The Kalauao Springs Bridge retains original parapets and original structural design. The eastbound bridge has one 1936 parapet, end stanchions, and structure that are typical of reinforced-concrete bridges constructed in Hawaii in the latter half of the 1930s. The westbound bridge still has one 1945 parapet, two end stanchions, and its structural system, all of which are typical of reinforced-concrete bridges constructed in Hawaii during the 1940s. Both the eastbound bridge and westbound bridge have a parapet design featuring cross-shaped voids. The 1936 curved end stanchions are typical of bridges up to that date, and the rectangular stanchions are typical of bridges built in the 1940s. The eastbound bridge is approximately 45' in length, with a single span, while the westbound bridge has two spans and a total length of about 54'. The 1966 additions to the bridges are quite different in the design of their structure, parapets, and stanchions. This contrast, however, conveys the history of the area and its rapid

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<sup>24</sup> "Aiea Highway Link Dedicated," *Honolulu Star Bulletin*, August 25, 1937. p. 6.

<sup>25</sup> "New Aiea Road Open August 20," *Honolulu Star Bulletin*, August 3, 1937. p. 5.

<sup>26</sup> "Aiea Highway Link Dedicated," *Honolulu Star Bulletin*, August 25, 1937. p. 6.

<sup>27</sup> Walker-Moody Construction Company, Ltd., "The Walker Moody Story – Company History, Start – 1940," On website at <http://www.walker-moody.com/inde.php/company-history-start-1940.html>, accessed on June 13, 2012.

<sup>28</sup> Ibid. (in Olund biography section).

post-statehood growth. The 1966 sections of the bridges are not considered detracting features.

2. **Condition of Fabric:** Good. The overall integrity of the property remains high, except for the setting, which has changed from rural to urban. The guardrail additions are minor alterations.

## **B. Description:**

Both reinforced-concrete three-lane bridges cross the waterway created by the outflow of Kalauao Springs, also known as Kalauao Springs Ditch.<sup>29</sup> Eastbound traffic travels on the *makai* bridge and the *mauka* bridge carries westbound traffic. The *makai* eastbound bridge has a single span of about 40'. The *mauka* westbound bridge has a more complex design; there are two spans, each approximately 26', on the 1945 section, and a single span of about 51' on the 1966 section. Both the eastbound bridge and westbound bridge have a roadway approximately 40' wide. Each bridge has one or two concrete walkways approximately 4' wide, which are about 4" higher than the roadway surface. The eastbound bridge has walkways along both its *mauka* (1936) parapet and along its *makai* (1966) edge, while the westbound bridge has a walkway only along its *mauka* (1966) parapet. The walkway along the 1936 parapet is now in the highway median and utilized by few pedestrians.

The inner parapet on each bridge is comprised of the original parapet and stanchions, from either 1936 (on the eastbound bridge) or 1945 (on the westbound bridge). This original (1936 & 1945) construction on each bridge includes the structure supporting the two traffic lanes adjacent to the original parapets. The 1966 widening increased the width of each bridge from two to three traffic lanes and built replacement walkways along the new parapets.

### **Eastbound Bridge (1936/1966)**

This bridge has three traffic lanes on an asphalt-surfaced roadway. The 1936 concrete parapet and stanchions are on the *mauka* side of this bridge. This parapet is 2'-10" high and about 40' long. The parapet has a top railing 1'-0" wide and 7" high with 1½" stepped corners. Below the railing is a series of vertical concrete balusters (6" wide and 6" thick) that are typically spaced at 1'-7" on centers. The sections of each parapet that are between the balusters are slightly thinner (4" thick) and each section was formed 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.<sup>30</sup> Each cross void is 1'-3" high and 8" wide. The base of the 1936 parapet is 7" high and 10" thick, along its full length. On the inboard side of the parapet is a walkway, 3'-0" wide and about 4" higher than the road pavement. The height differential results in an approximately 4"-high concrete curb along the road.

The 1936 concrete end stanchions are 3'-3" high (measured from the roadway), 1'-9" thick, and about 4' long. In plan, they form an arc of a circle spanning about 30 degrees. One stanchion end squarely abuts the parapet and the stanchion arcs 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. The west stanchion has an added wedge of concrete on its outer (road-facing) surface that anchors a steel W-beam guardrail, which extends along the roadway at the approach. Typically, concrete bridges of this type and period have year built and name

<sup>29</sup> State of Hawaii, Taxation Maps Bureau, First Division, Zone 9, Section 8, Plat 14. June 1975.

<sup>30</sup> Heritage Center, School of Architecture, University of Hawaii at Manoa, State of Hawaii, Historic Bridge Inventory and Evaluation (Draft prepared for the State of Hawaii, Department of Transportation, Highways Division) 2008. p. I-30.

KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116 (Page 9)

inscriptions on their end stanchions. However, the concrete wedge covers the name inscription on this stanchion. The east end stanchion has the date inscription "1936" in 3" high block numbers.

The 1966 parapet and end stanchions of the eastbound bridge are on its *makai* side. The lower part of the 1966 parapet is concrete, 1'-2" thick and 1'-6" high. There is a horizontal line incised across it, at the height of 9". The upper section of the 1966 parapet is a metal railing composed of two horizontal cylinders supported by slightly curved rail posts. The bottom rail is 5" in diameter and the top rail is 3" in diameter. The posts are spaced about 7' apart along the length of the parapet. The posts are bolted to the top surface of the lower concrete section. The 1966 end stanchions are rectangular concrete, 1'-2" thick, 3'-1" high, and 5'-0" long. Each has 1"-wide horizontal lines incised around its circumference, at heights of 9" and 1'-6" above the walkway. The west stanchion has the inscription "Kalauao Springs Bridge 1966" in 3" high block lettering. The added steel guardrails partially obscure this inscription.

The underside of the eastbound bridge was not accessible for observation. The bridge has concrete abutments, which the 1965 drawings show are supported by piles.<sup>31</sup>

### **Westbound Bridge (1945/1966)**

The westbound bridge has three traffic lanes on an asphalt-surfaced roadway. The 1945 concrete parapet and stanchions are on the *makai* side of this bridge. This parapet is almost identical to the 1936 parapet described above; however, instead of having a walkway extending along its length, it has a 6"-high, 10"-wide concrete curb.

Another difference is the 1945 concrete end stanchions are rectangular, not curved. The newer stanchions are similar in height and thickness, but shorter in length than the 1936 ones; the 1945 stanchions measure 3'-3" high, 1'-9" thick, and 3'-6" long. Each end stanchion has 1½" stepped corners and squarely abuts the parapet. The east end stanchion has an added W-beam guardrail that is through-bolted to it. Although the guardrail partially obscures the name inscription, "Kalauao Springs" can be read beneath it. The west end stanchion has no added guardrail and "1945" is inscribed in 3"-high block numbers.

The 1966 parapet of this westbound bridge was constructed exactly like the 1966 parapet of the eastbound bridge (see description above).

The underside of the 1945/1966 westbound bridge was not accessible for observation. From the bank of the waterway north of the bridge, there is a view of the different structural designs – the original 1945 bridge and the 1966 traffic lane and walkway. The 1945 portion that carries the two *makai* lanes has two spans, with a central line of support consisting of square-cross-section concrete piles topped by a transverse concrete beam or pile cap. The 1945 drawings show the 1945 piles are composites; the upper portions, labeled as concrete "Socket Piles," have wider bottom sections that fit over the lower "Untreated Timber Piles." The added 1966 portion carries the third lane and walkway on the *mauka* side of the bridge. Its two longitudinal prestressed concrete girders cross the waterway in a single span. The bridge abutments are board-formed concrete.

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<sup>31</sup> State of Hawaii, Department of Transportation, Highways Division, Design Branch, FAP No. U-090-I (9), Kalauao Springs Bridge Widening, Drawing 67. June 1965.

### **C. Site Information:**

The Kalauao Springs Bridge is located along a primarily urban section of Kamehameha Highway. In Hawaii, roads are not given Tax Map Key (TMK) designations. This bridge lies just south of TMK 9-8-016: 045, which the tax map labels "Drainage Channel."<sup>32</sup> *Mauka* of the highway, to the northeast, and wrapping around the Sumida Farm, is the expansive Pearl Ridge Shopping Center, built circa 1969 (with additional phases of development in later years). Sumida Farm is directly northwest of the bridge; it has several acres of watercress under cultivation, and is an anomaly in this urban area. *Makai* of the highway, to the southeast is a low-rise strip mall, and to the southwest of the bridge are an automotive shop and two gas stations. The setting around the bridge has changed greatly since its original 1936 construction dates. Historic aerial photos show that before World War II the area was rural, with small farm plots in an area slightly larger than that now occupied by Sumida Farm. Surrounding these plots, primarily *mauka* of Kamehameha Highway, were sugarcane fields. Post-World War II development of housing and businesses along this corridor was accommodated or spurred by the addition of the 1945 bridges, and by the 1966 widening of all six bridges in this segment of Kamehameha Highway.

### **Part III. Sources of Information:**

#### **A. Primary Sources:**

##### Architectural Drawings and Early Views

No original (1936) drawings or early photographs of the bridge were located for this report.

The 1945 and 1966 construction drawings are electronic files (scans) located in the database at the State of Hawaii, Department of Transportation, Highways Division, Design Branch:

1945 – Hawaii Project No. DA-WR 10 (3), dated June 18, 1945.

1966 – FAP No. U-090-I (9), dated July 22, 1965.

Drawings of the Kalauao Springs Bridge in this database 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. The maps were created and published by the U.S. Geological Survey and are public domain materials. Aerial photos in the collection of the Hawaii State Archives were created for or collected by the Hawaii Territorial/ State Land Use Bureau and are unrestricted public records.

#### **B. Secondary Sources:**

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<sup>32</sup> State of Hawaii, Taxation Maps Section, First Division, Zone 9, Section 8, Plat 16. December 1984.

KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116 (Page 11)

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"Allotment to Hawaii Roads is Agreed On." August 3, 1933. p. 1.

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"Cain Submits Road Plan to U.S. Officials." May 3, 1935. p. 1.

"Cain Reveals Road Scheme for 5 Islands." March 6, 1937. p. 1.

"New Aiea Road Open August 20." August 3, 1937. p. 5.

"Ceremony Will Open New Road." August 23, 1937. p. 7.

"Aiea Highway Link Dedicated." August 25, 1937. p. 6.

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State of Hawaii, Taxation Maps Bureau (or Section). Tax Map, First Division, Zone 9, Section 8, Plat 14 (and Plat 16). June 1975 (and December 1984). [Available at the City and County of Honolulu, Real Property Assessment Office.]

Superintendent of Public Works. *Report to the Governor, Territory of Hawaii, for the Year Ending June 30*. Honolulu: Various Publishers. Various Years.

Territorial Highway Department, Hawaii Highway Planning Survey. Bridge Inventory for the Island of Oahu. Prepared in Cooperation with the U.S. Department of Commerce, Bureau of Public Roads. September 1950.

Thompson, Bethany. Historic Bridge Inventory, Island Of Oahu. Prepared for the State of Hawaii, Department of Transportation, Highways Division. June 1983.

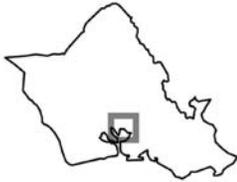
Walker-Moody Construction Company, Ltd. "The Walker Moody Story – Company History, Start – 1940." On website at <http://www.walker-moody.com/index.php/company-history-start-1940.html>, accessed on June 13, 2012.

**C. Likely Sources Not Yet Investigated:**

National Archives and Records Administration files for the U.S. Department of Transportation, Federal Highway Administration and for predecessor agencies such as U.S. Department of Commerce, Bureau of Public Roads.

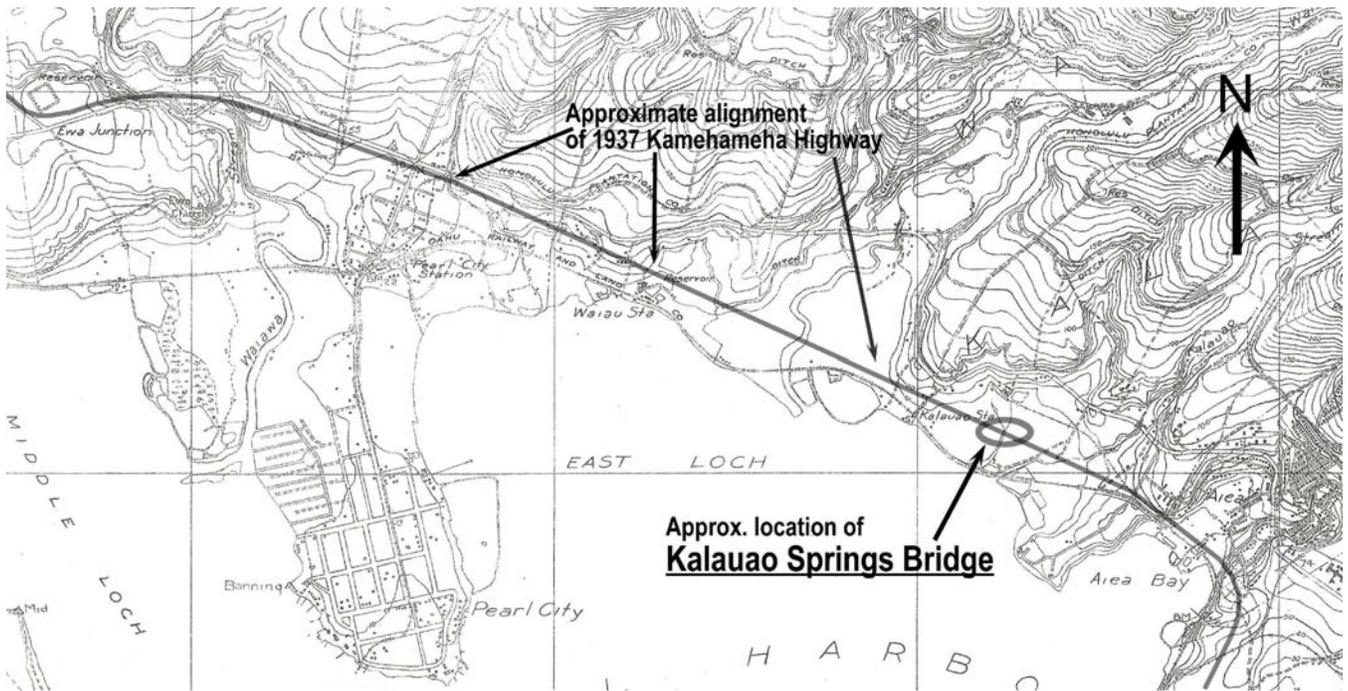
KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116 (Page 12)

Location Map



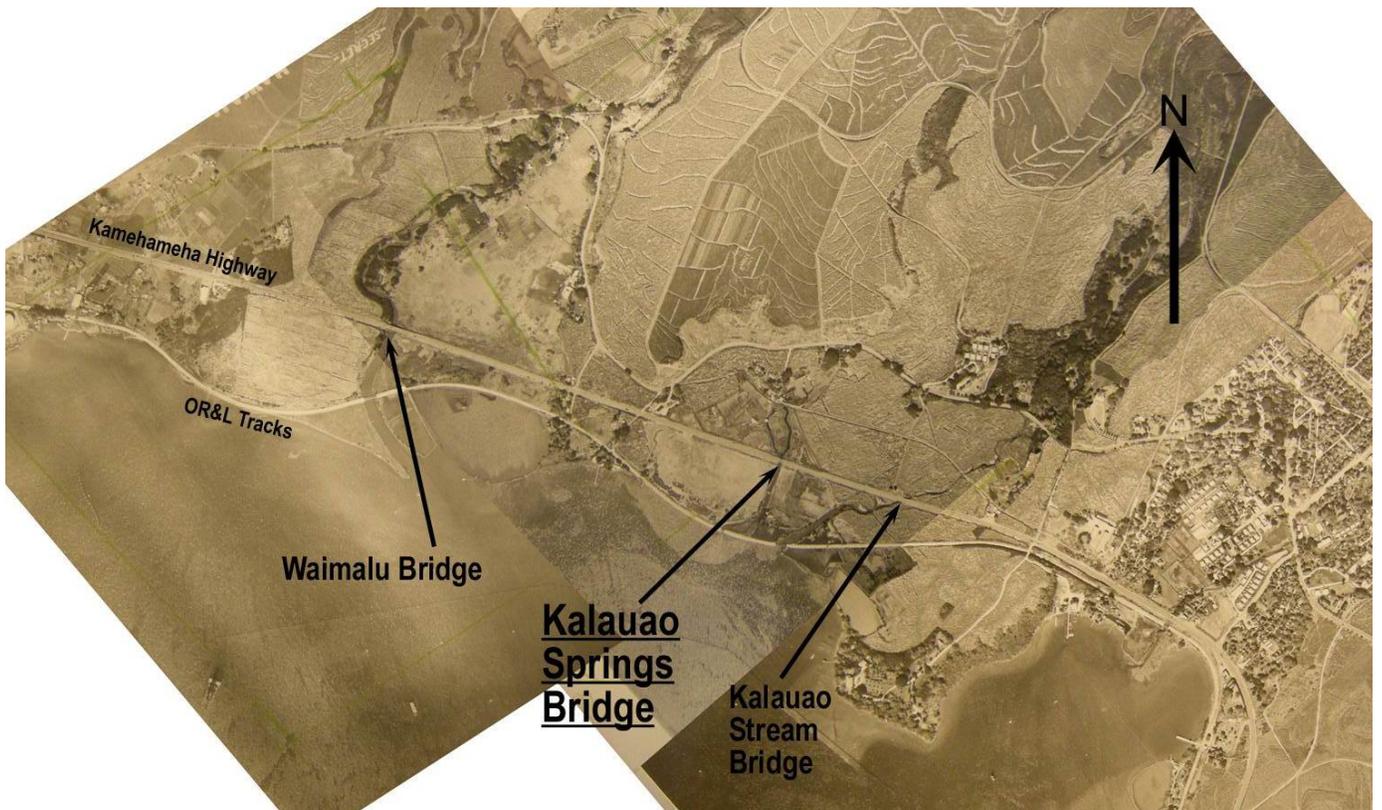
KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116 (Page 13)

Portion of topographic map from 1927 showing the area around the (future) Kalauao Springs Bridge. The approximate alignment of Kamehameha Highway, which would be opened in 1937, has been added. *U.S. Geological Survey. Waipahu Quadrangle, 1:20,000, 1927.*



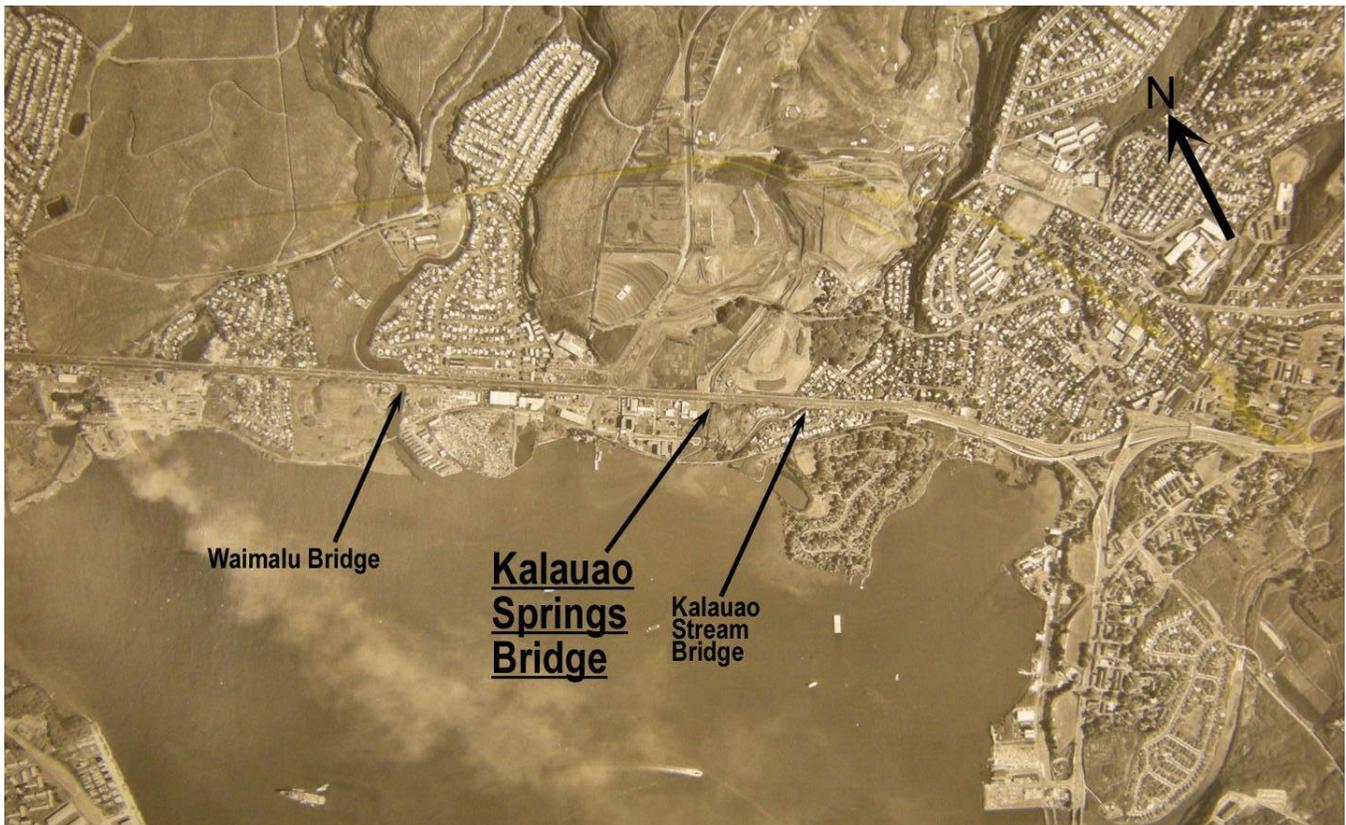
KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116 (Page 14)

Composite of aerial photos, ca. 1940, showing the area around the Kalauao Springs Bridge (added lettering and arrows). *Hawaii State Archives, Folder PPA-59-1, photos M-58.67 & M-58.69, and Folder PPA-58-5, photo M-58.37 (public domain). U.S. Army Air Corps 1939-41.*



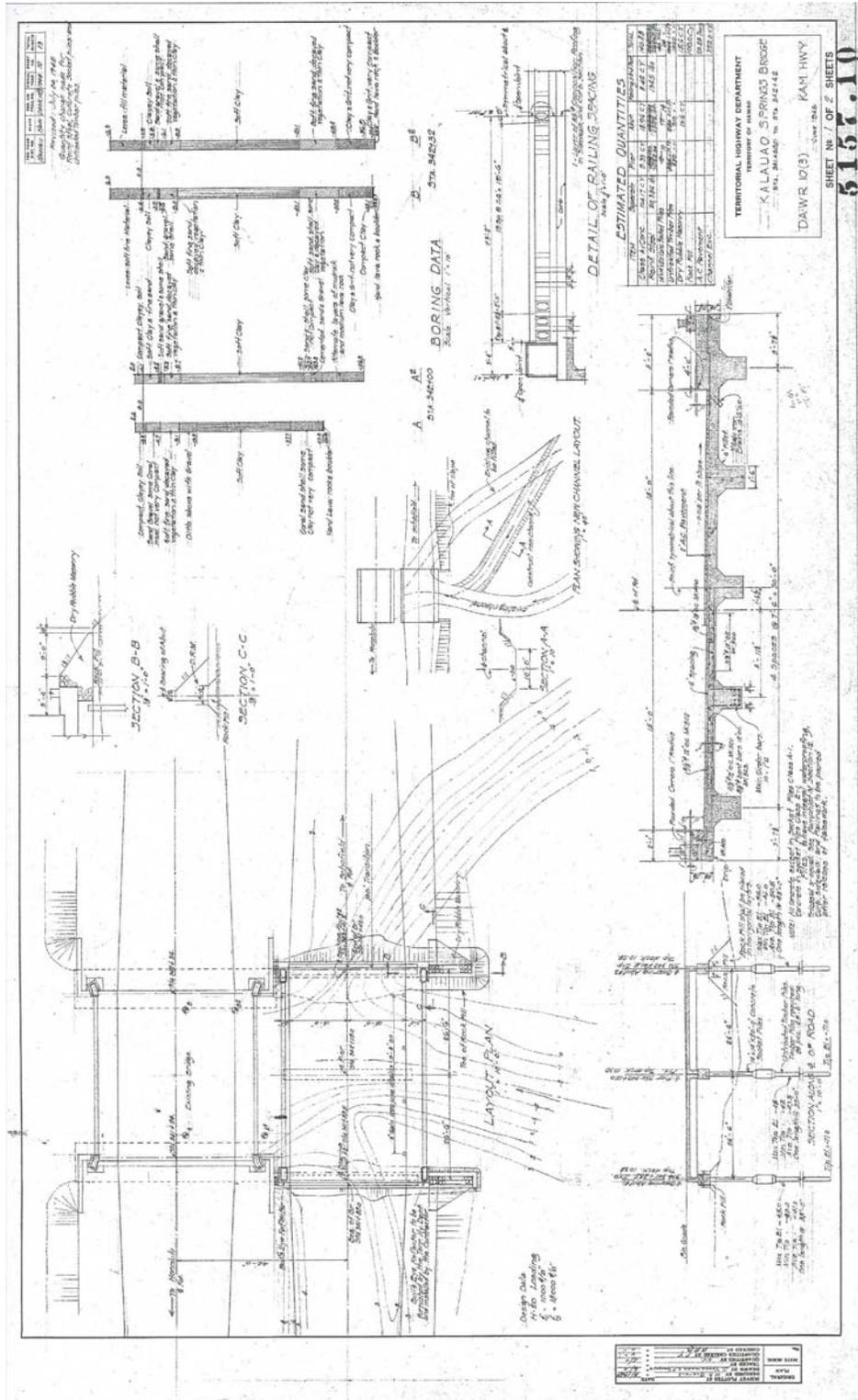
KALAUAO SPRINGS BRIDGE  
(Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
HAER No. HI-116 (Page 15)

Aerial photo dated February 6, 1968, showing the area around Kalauao Springs Bridge (added lettering and arrows). *Hawaii State Archives, Folder PPA-49-3, photo 2-14 (public domain).*



**KALAUAO SPRINGS BRIDGE**  
 (Kalauao Springs Eastbound Bridge & Kalauao Springs Westbound Bridge)  
 HAER No. HI-116 (Page 16)

Original drawing of Kalauao Springs Bridge. State of Hawaii, Department of Transportation, Highways Division, Design Branch, Project No. DA-WR 10 (3), Drawing 5157.10, June 1945.



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

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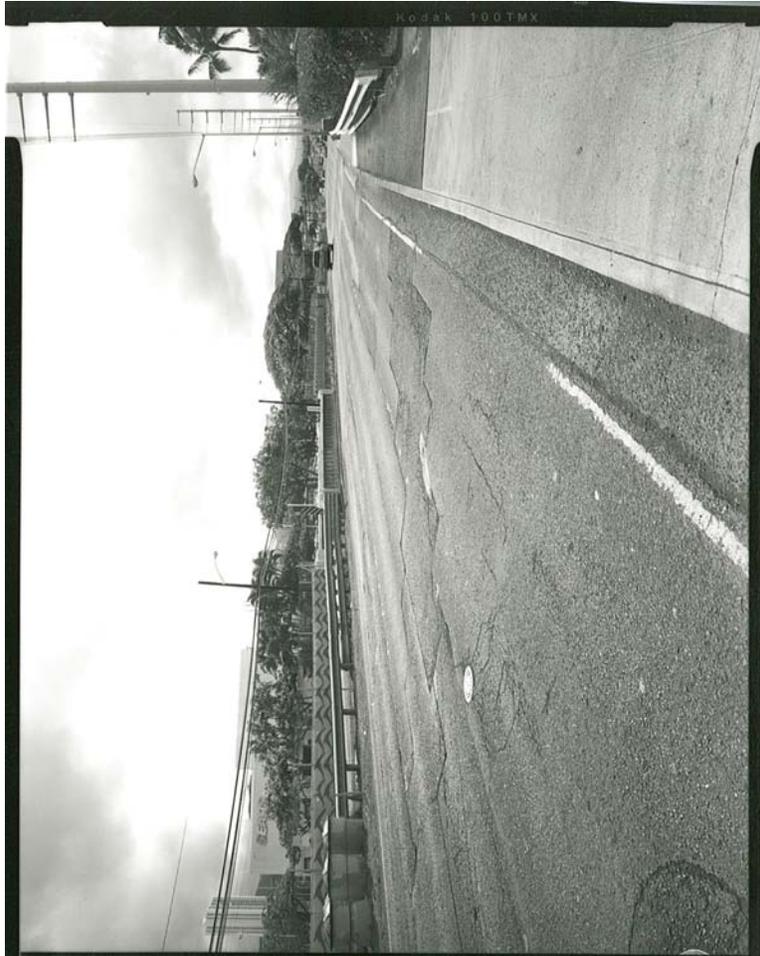
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**HAER No. HI-116-3**



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**HAER No. HI-116-7**



