The Historical Progression of Transportation in Mākaha

From Railways to Highways

OR&L Ruins
Source: HAER-90

Bridge 3
Source: HAER-90

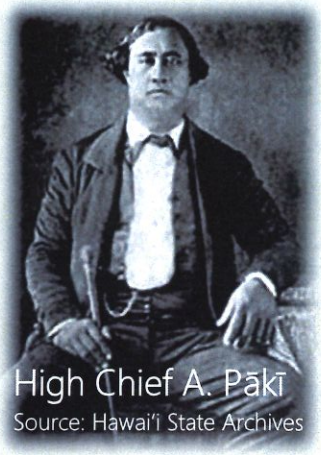
Bridge 3A
Source: HAER-90

This brochure is prepared in accordance with the Memorandum of Agreement (MOA) for the Farrington Highway Mākaha – Bridge No. 3 and No. 3A Replacement Project, Federal Aid Project No. BR-093-1(20), pursuant to 36 CFR Part 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f).

The information provided in this brochure is from sources that include, but not limited to: The National Register of Historic Places (NRHP), a Historic American Engineering Record (HAER) report; and the Final Environmental Assessment (FEA) including an Archaeological Inventory Survey (pursuant to Hawai'i Revised Statues, Chapter 6E) and Cultural Impact Assessment (pursuant to Session Laws of Hawai'i, Act 50). Together, these documents provide detail and the rich history of the 1930s era Mākaha Bridges which have long provided the community with roadway access along the Wai'anae Coast of O'ahu.

A Brief History of the Mākaha Bridges and Region

The Mākaha Bridges are located in the Mākaha Ahupua`a in the Wai`anae District of the Island of O`ahu. The two bridges, Bridge No. 3 on the Honolulu side, and No. 3A on the Ka`ena side, are two of the last remaining wood framed timber bridges on O`ahu. From the time of their construction in the 1930s, and period of long use for almost 80 years, the bridges have faithfully served the community by providing access along the Wai`anae coast. Today, these historic bridges are reaching the end of their useful service life and are in need of replacement. This brochure presents the story and history of the bridges, constructed as an outcome of the 1930's Great Depression, through its period of use alongside the trains of the O`ahu Railway and Land Company (OR&L), and up to its more recent use, and eventual need for replacement today.



High Chief A. Pākī
Source: Hawai'i State Archives

Hawaiian folklore tells of the abundance of marine resources once prevalent in the region and of how the area came to be named after the young chief, Mākaha. Early accounts describe Mākaha as having a large inland settlement and a smaller coastal settlement. Mākaha Stream allowed for traditional small-scale wetland taro agriculture and a brackish water fishpond at the mouth of the stream. In the early 1800s, Mākaha residents left farming and agriculture to harvest and trade sandalwood to western sailors. The Organic Acts of 1845 and 1846 initiated the process of Māhele, or the division of Hawaiian Lands. Mākaha supported the second largest population in the Wai`anae region, however, during the Māhele, there were only 13 claims filed for the Mākaha Ahupua`a, of which seven were awarded with six located inland and the last claiming a *muliwai*, or estuary at its western boundary. In 1850, High Chief Abner Pākī was awarded 5,000 acres through the Māhele and held claim over most of Mākaha. After the death of Pākī in 1855, the land was sold to James Robinson and Co. for $5,000.

Owen James Holt, an investor of James Robinson and Co., proceeded to buy out shares of land for Mākaha from other investors and became a dominant influence on the economic and social environment of Mākaha, as well as its land use patterns, until the end of the nineteenth century. Between 1887 and 1899, the Holt Ranch raised horses, cattle, pigs, goats, and peacocks. After Holt's death in 1891, the land went into a trust for his children. During the early 1900s, the Holt Ranch started to sell off land to the Wai`anae Sugar Company and by 1923, the

Aerial View of Mākaha Bridges 3 and 3A
Source: Google Maps

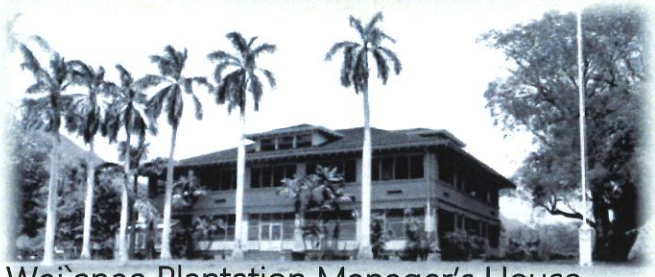
majority of the lower Mākaha Valley was under large-scale sugar cultivation. Sugar cultivation lasted in the Mākaha area until 1946, when the Wai`anae Sugar Company began selling about 10,000 acres of land due to increased operating costs. An investor of the Honolulu Stock Exchange, Chinn Ho, brokered a deal with the Wai`anae Sugar Company to buy the land. He tried to convert the large-scale sugar cultivation back to ranching but the issue of water scarcity remained. Instead, Ho invested in a resort development that included a luxury hotel, golf course, tennis courts, and restaurants for local and tourist use. He also sold off parts of his land for beach lots, shopping centers, and property lots that were bought by many former Wai`anae Sugar Company's plantation workers.

Transportation in Early Mākaha

In the early 1800s, the predominant means of transportation was by foot. Trails typically kept to the natural contours and terrain of the land. This meant that most of the trails followed the Mākaha coastline. With the introduction of horses, cattle, and wagons, the trails were widened and graded to accommodate these newer modes of transportation. The first major landscape altering transportation activity occurred during the 1880s when the Wai`anae Plantation Railroad and later OR&L built the railroad from Honolulu to Ka`ena Point to support large-scale sugar cultivation in Wai`anae. The railroad had a major effect on the natural features of the Wai`anae Coastline, with sand dunes and coastal fishponds displaced to accommodate the railroad tracks. This early form of modern transportation also transformed the coastal viewplane with locomotive engines billowing coal and wood fired steam and smoke, and railroad cars hauling harvested sugarcane, plantation workers, and passengers.

The O`ahu Railway & Land Company

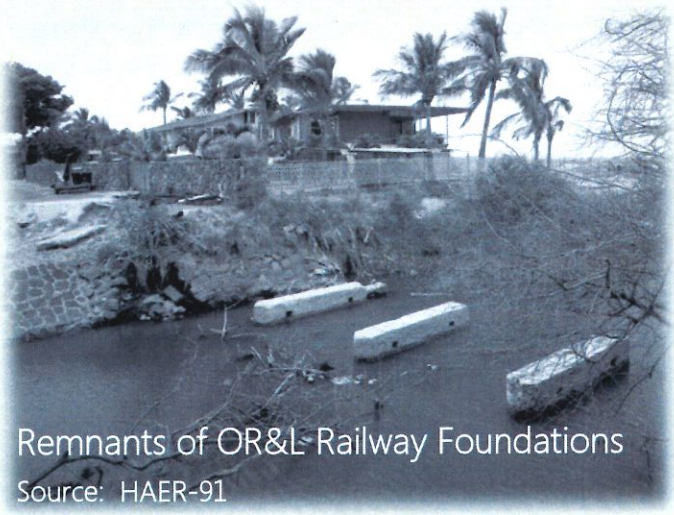
Following the successful boring of artesian wells by James Campbell in the 'Ewa district, Benjamin Franklin Dillingham received permission to charter a steam railroad "for the carriage of passengers and freight" from the Hawai`i Legislature and King Kalākaua in 1888. Dillingham decided to lease 41,000 acres in 'Ewa and 15,000 acres in Kahuku



Wai`anae Plantation Manager's House
Source: Historic Hawai`i Foundation

Chinn Ho
Source: FreedomMentor.com

Construction of the OR&L Railway
Source: HAER-91



Remnants of OR&L Railway Foundations
Source: HAER-91

from Campbell in 1889. Later in 1889, Dillingham received private economic support and was able to charter the OR&L. During this time, Dillingham leased lands for, and encouraged, sugar plantation development in 'Ewa and Kahuku, which would later be known as the O'ahu Sugar Company.

Charles H. Kluegel was the lead civil engineer for construction of the OR&L railroad. The first tracks were made from German steel rails and the first rail segment opened on King Kalākaua's birthday in 1890 and ran from Honolulu to 'Aiea. By 1890, the tracks extended to Pearl City and by 1895 the tracks extended to Wai'anae. By 1899, the tracks extended to Kahuku and facilitated the boom in agriculture with passengers totaling almost 135,000 per year. The railroad was becoming so successful that by 1915, ridership had reached almost a million passengers per year. But in 1926, ridership declined due to the advent of affordable automobiles and highway improvements. World War II saw a revitalization of the railway with the transportation of military ammunition, supplies, and equipment, and ridership increased to just over two million passengers per year. Ridership declined again after the war and with damage sustained from the 1946 tsunami, the railway needed a major overhaul. The cost was economically infeasible and in 1947, OR&L operations outside urban Honolulu ceased. Dole still utilized their own rail line to transport pineapple between central O'ahu and the docks until 1972, at which time, all operations ceased.

Today, all that is left of the OR&L railroad in Mākaha are the concrete foundations that would have supported the railroad trestles that lie *makai* (seaward) of the Mākaha Bridges No. 3 and No. 3A. There are also deteriorating lava rock and mortar walls along the slopes of the stream bed of Bridge No. 3 that once protected against erosion.

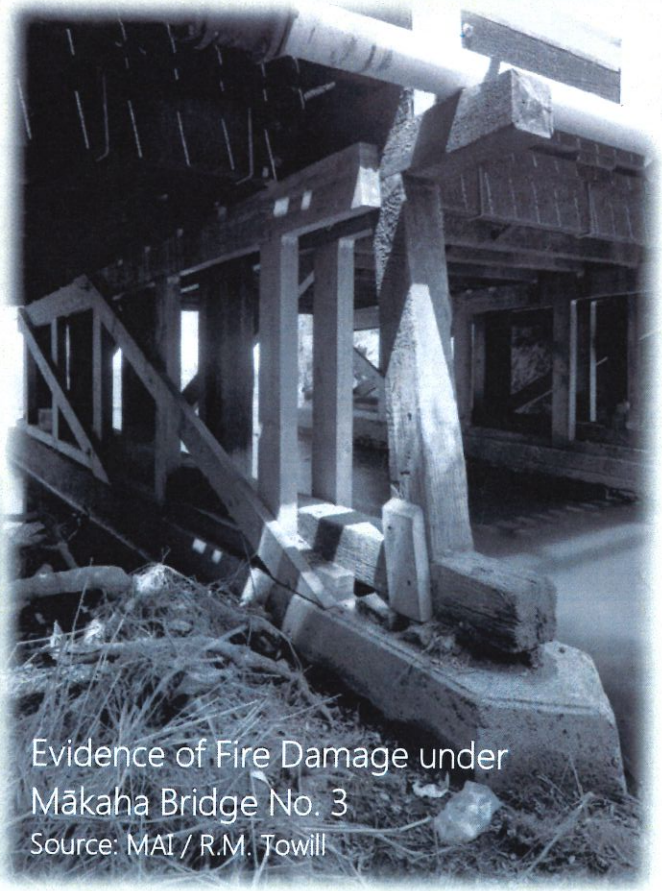
The First Car in Honolulu with H. Baldwin
Source: Hawai'i State Archives

Transition from Railroads to Highways

The first automobile arrived in Honolulu in 1899 causing quite a stir among the local people. One person described the first car as a "horseless carriage" which it would later be commonly referred to. The car was owned by Henry P. Baldwin and would be the start of a new era in transportation, and ultimately, the end of the railroad on O'ahu. However, roadway infrastructure and affordable automobiles began to be produced in the early 1930s, concurrently with the Depression Era (1929-1939) U. S. Works Progress Administration's (WPA) large scale public works projects to improve roadway infrastructure.

Depression Era Federal Work Programs

In 1933, as many as 15 million people in the U. S. were unemployed due to the Great Depression. At this time, President Franklin D. Roosevelt was dissatisfied with the low job growth under the Public Works Administration and started the Civil Works Administration (CWA). The CWA was in charge of constructing large scale public works projects. Expanding on the Civilian Conservation



Evidence of Fire Damage under Mākaha Bridge No. 3
Source: MAI / R.M. Towill

Corps and the Federal Emergency Relief Act work programs, the CWA employed over 2.6 million people for public improvements projects. But by 1934, the program had run out of funding and finally ended in March of that same year. During the congressional election congress re-instituted a work program called the Emergency Relief Appropriations and budgeted $4.8 million to states and territories in 1935 through the Works Progress Administration (WPA). From 1935 to 1936, Hawai'i was awarded $3.5 million to pay wages and was overseen by the Territorial Welfare and Relief Commission.

In 1938, the Federal Government announced that funding by WPA in Hawai'i would be controlled by the U. S. Army Corps of Engineers. Despite protests from the Governor and Legislature, WPA funds were re-appropriated for the completion of Kolekole Pass and the preparation of the U. S. for eventual entry into World War II. By 1941, WPA funding for Hawai'i was terminated; although it continued in the other states until 1944.

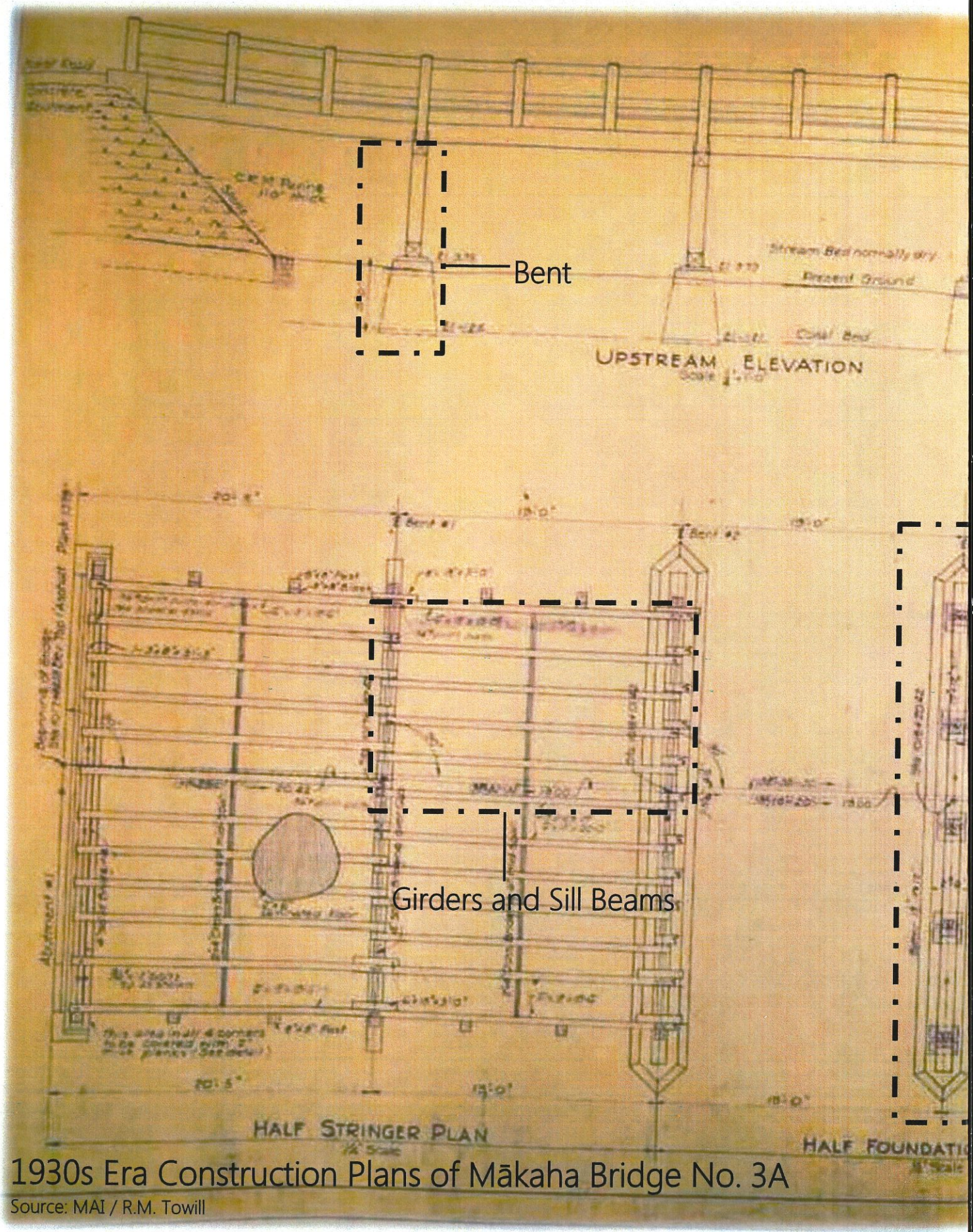
During the eight year existence of the WPA program, 8.5 million jobs were created and $10.5 billion was distributed. Most workers funded by the WPA were laborers but approximately 50,000 workers were teachers, historians, architects, and window dressers.

The program was responsible for the construction of 650,000 miles of road, 78,000 bridges, 125,000 civilian and military buildings, 800 airports, and produced 475,000 works of art.

The History of Mākaha Bridges No. 3 and No. 3A

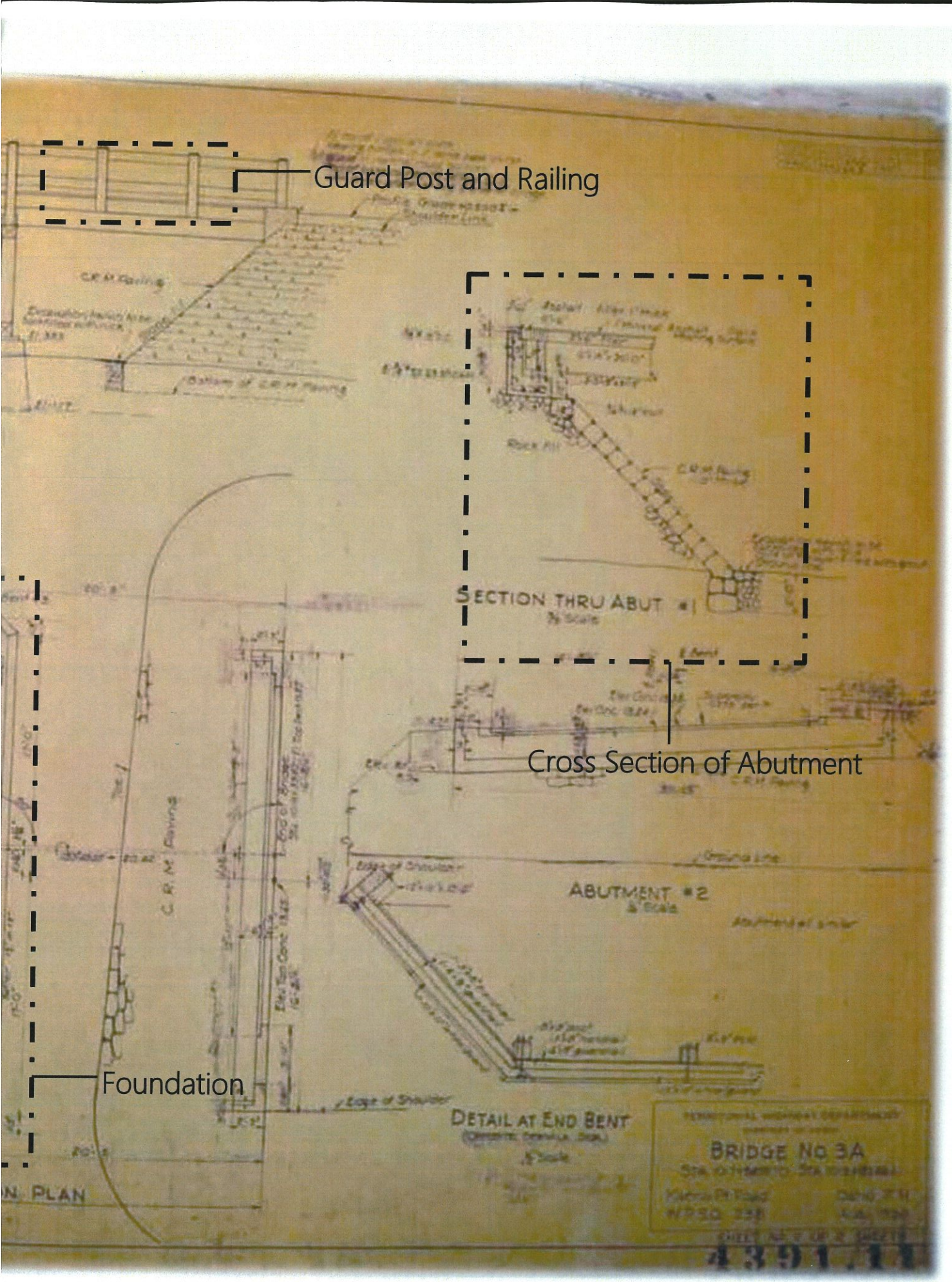
In 1937, the Ka'ena Point Road Project was one of 59 projects in Hawai'i funded by the WPA. The Ka'ena Point Road project extended from Kaupuni to Mākua and ran parallel to, and *mauka* (inland) of, the OR&L railroad tracks. There were a total of nine timber framed bridge crossings called for which would be constructed with the intent of providing "...all-weather access to the westernmost portion of O'ahu, hitherto inaccessible in rainy weather". The Ka'ena Point Road and bridges were intended to be a segment of the Farrington Highway, which was planned to ultimately wrap around Ka'ena Point with a connection to the Kamehameha Highway at the Hale'iwa Junction. This more ambitious connection, however, was never completed and the end of the Farrington Highway terminates a little over a half mile from Keawa'ula Beach Park, also known as Yokohama Beach.

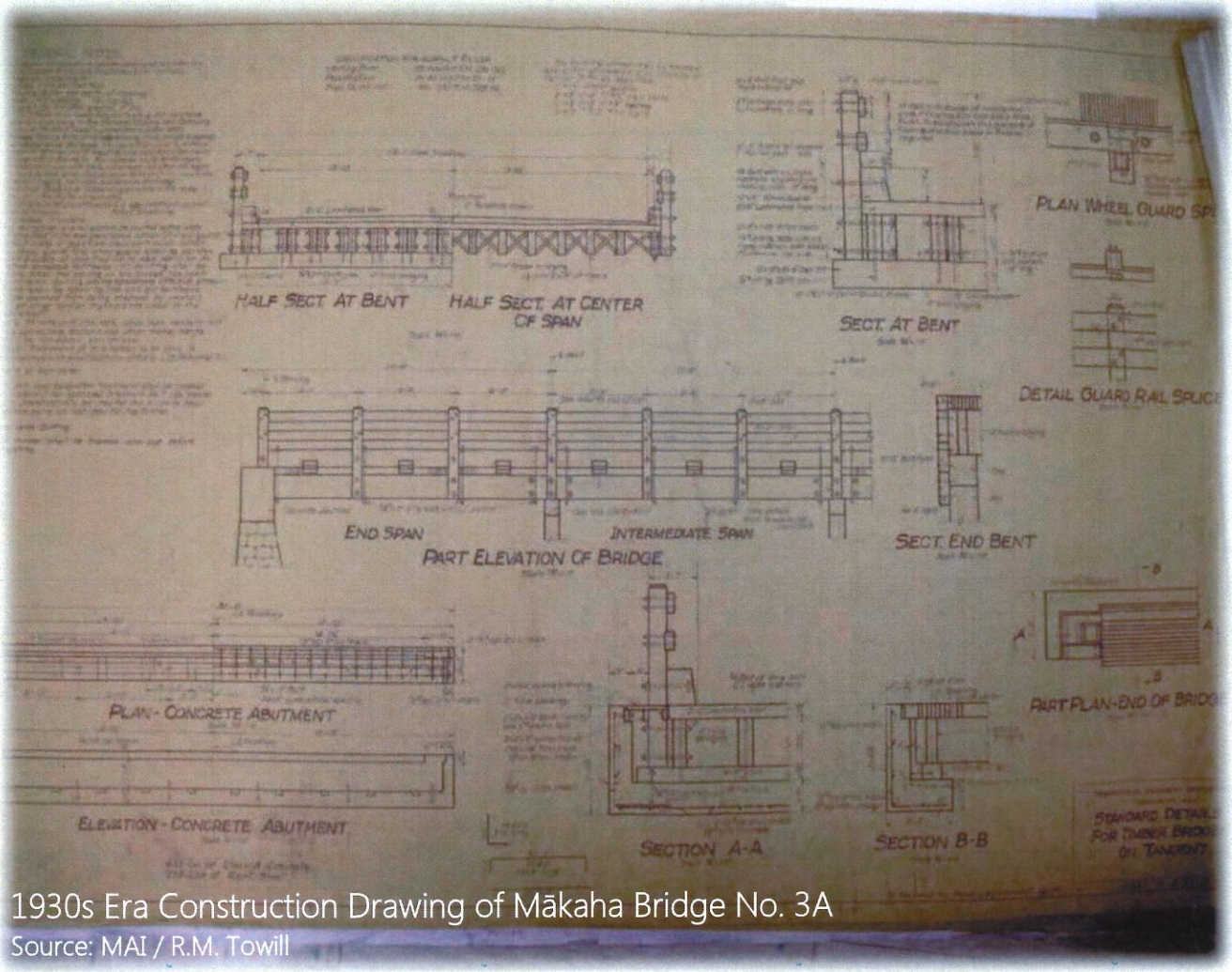
View Under Mākaha Bridge No. 3A
Source: MAI / R.M. Towill



1930s Era Construction Plans of Mākaha Bridge No. 3A

Source: MAI / R.M. Towill


Guard Post and Railing
SECTION THRU ABUT #1
Cross Section of Abutment
ABUTMENT #2
Foundation
DETAIL AT END BENT
BRIDGE NO 3A
4391.11



1930s Era Construction Drawing of Mākaha Bridge No. 3A
Source: MAI / R.M. Towill

Mākaha Bridges No. 3 and No. 3A took 124 men to construct and were built with creosoted Douglas fir timber, atop a 4 foot high lava rock foundation with a 1 foot thick concrete cap. Bridge No. 3 is just south of Kili Road, spans 60 feet across Mākaha Stream and is approximately 8 feet above the stream bed. Bridge No. 3A is just north of Kili Road, spans 78 feet across the West Mākaha Stream and is approximately 11 feet above the stream bed. The bridges have a laminated plank deck that is covered in asphalt.

The original 1937 concept called for the bridge structures to be of concrete construction. However, due to the high cost of building materials, the use of timber to construct the bridge framing and local lava rock for the foundations, helped to keep costs low since funds from the WPA could not be used to purchase materials or equipment. This type of historic construction is unique and not found intact elsewhere on O'ahu. The other seven bridges built during the Ka'ena Point Road Project may have been similarly constructed; however, these bridges have since been replaced over the decades with more modern bridges meeting current design and safety standards.

Mākaha Bridges No. 3 and No. 3A are considered historically significant and are identified by the State Historic Preservation Division (SHPD) as eligible for listing on the NRHP. The bridges are the last remaining timber (wooden) framed bridges constructed for the 1937 Ka'ena Point Road project, and are significant for their associations with the development of O`ahu's highway system during the 1930s. They reflect the era of the period in their materials, method of construction, workmanship, and design.

To address the history of the Mākaha Bridges, a Historic American Engineering Record (HAER) report was written to document the architectural and engineering achievement in the construction of the bridges. In the 79 years after construction and a long life of service to the Wai`anae community, the bridges have exceeded their design lifespan. Although current

maintenance and repair has enabled the bridges to continue to be safely used, the bridges are classified by the Hawai'i Department of Transportation (HDOT), Highways Division as structurally deficient and in need of replacement.

The Construction of Mākaha Bridges No. 3 and No. 3A

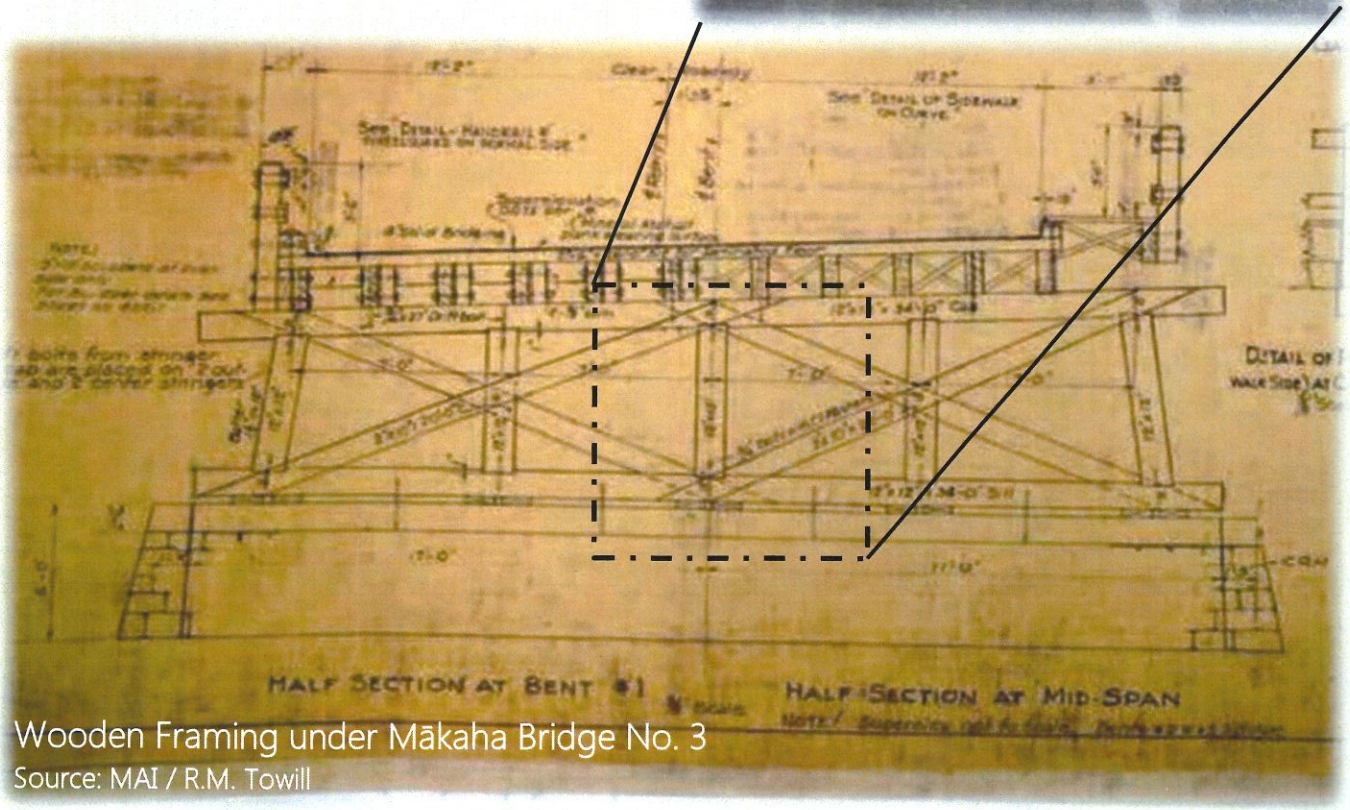
Mākaha Bridge No. 3 is a 3 span creosoted timber bridge measuring 60 feet long with a girder and floor beam structure. The bridge sits on 4 foot high lava rock foundations with tapered ends and a 12 inch concrete cap on top. The foundations are 36 feet 6 inches long and taper from 3 feet 8 inches wide at the base to 2 feet 6 inches wide at the top at a 1:8 slope. Along the stream bank, there are 12 inch thick lava rock and mortar walls set at a 1:1 slope to protect the stream banks from erosion.

There are 2 bays that are 17 feet in length and feature 5 piers spaced 7 feet on center. Bents (reinforced concrete or steel frames that support the vertical load of the bridge) that sit on the foundations are composed of 12 inch by 12 inch beams and piers with 3 inch by 10 inch cross bracing held together by large nuts and bolts. There are fourteen 6 inch by 18 inch girders with 2 inch by 4 inch cross bridging. The girders are carried by 32 foot long concrete abutments and sit on 6 inch by 8 inch sill beams.

The bridge has a 2 inch by 6 inch laminated plank deck covered in asphalt that sits on top of the girders. Scuppers that drain the deck are centered between the posts and a battered 10 inch by 12 inch wide wheel guard runs along the base of the guard rail on the downstream side of the bridge.

Guard posts and railing along the bridge consisted of 8 inch by 8 inch posts that are 4 feet long and spaced 6 feet 4 inches on center from each other. The rails are 2 inch by 4 inch lumber affixed to the inside face of the posts. The sidewalks are 4 feet wide and sit 10 inches above the roadway. The bridge roadway is 36.1 feet with a maximum span of 19 feet.

Mākaha Bridge No. 3A measures 78.1 feet in length and is 4 spans long. The bridge is similar in design,



Wooden Framing under Mākaha Bridge No. 3
Source: MAI / R.M. Towill

Mauka View of Mākaha Bridge 3A
Source: MAI / R.M. Towill

construction and material to Mākaha Bridge No. 3. The structure is the same except Mākaha Bridge No. 3A has 3 bents instead of the 2 at Bridge No. 3, and 13 guard rail posts.

Mākaha Bridges 3 and 3A Replacement Project

The Hawai'i Department of Transportation (HDOT), Highways Division is proposing to replace the current wooden Mākaha Bridges No. 3 and No. 3A with reinforced concrete structures that meet current highway design standards. The Mākaha Bridges were built in 1937 and have had minor maintenance and repairs since their initial construction. The Bridges had asphalt resurfacing in 1986 and structural reinforcement after a fire that caused damage Bridge No. 3 in 2006. The bridges are regularly evaluated and given a bridge sufficiency rating. This rating assesses: the qualities of the bridge; structural adequacy and safety; serviceability; and essentiality for public use.

After the 1997 inspection, Bridge No. 3A was rated at 20.5 points out of 100 points and Bridge No. 3 was rated at 17 points. Any scores below 50 points are eligible for federal funding and are recommended to be replaced. Bridge No. 3 was recommended for rehabilitation, but after further discussion and the damage caused by the fire, the recommendation was changed to replace Bridge No. 3.

The replacement bridges would be made from reinforced concrete and have 12-foot-wide lanes to allow larger vehicles to utilize the bridges. There would also be 10 foot wide shoulders to allow for bicyclist and pedestrian traffic. Improvements to the foundations of the bridge abutments and aprons will be made using reinforced concrete. Riprap will be utilized to provide erosion protection upstream of the bridges.

Makai View of Mākaha Bridge 3A
Source: MAI / R.M. Towill

Additionally, the proposed bridge replacements will provide sufficient flow capacity to accommodate a 100-year flood event without overtopping or negatively impacting upstream properties.

Acknowledgments

HDOT and FHWA would like to acknowledge the following organizations and companies for their dedication and hard work in providing the necessary information and reports needed to complete this brochure:

- State Historic Preservation Officer
- Advisory Council on Historic Preservation
- Cultural Surveys Hawai'i, Inc.
- Mason Architects, Inc. (MAI)

Upstream View of West Mākaha Stream
Source: MAI / R.M. Towill

References

The following references are used for the information and photographs provided in this brochure.

1. R.M. Towill Corporation (April 2010). *Farrington Highway Replacement of Mākaha Bridges No. 3 and No. 3A, Final Environmental Assessment*.

2. Historic American Engineering Record (HAER). (August 2009). *Mākaha Bridges 3 & 3A Spanning Mākaha Stream at Farrington Highway*. Retrieved October 10, 2017, from http://www.loc.gov/pictures/item/hi0897/

3. Historic American Engineering Record (HAER). (August 2009). *O'ahu Railway & Land Company Trestle Ruins Farrington Highway*. HAER Call Number: HI-91. Retrieved October 10, 2017, from http://www.loc.gov/pictures/item/hi0898/

4. (March 2012). Memorandum of Agreement among the Advisory Council on Historic Preservation and Hawai'i State Historic Preservation Officer regarding Farrington Highway Mākaha – Bridge No. 3 and No. 3A Replacement Project.

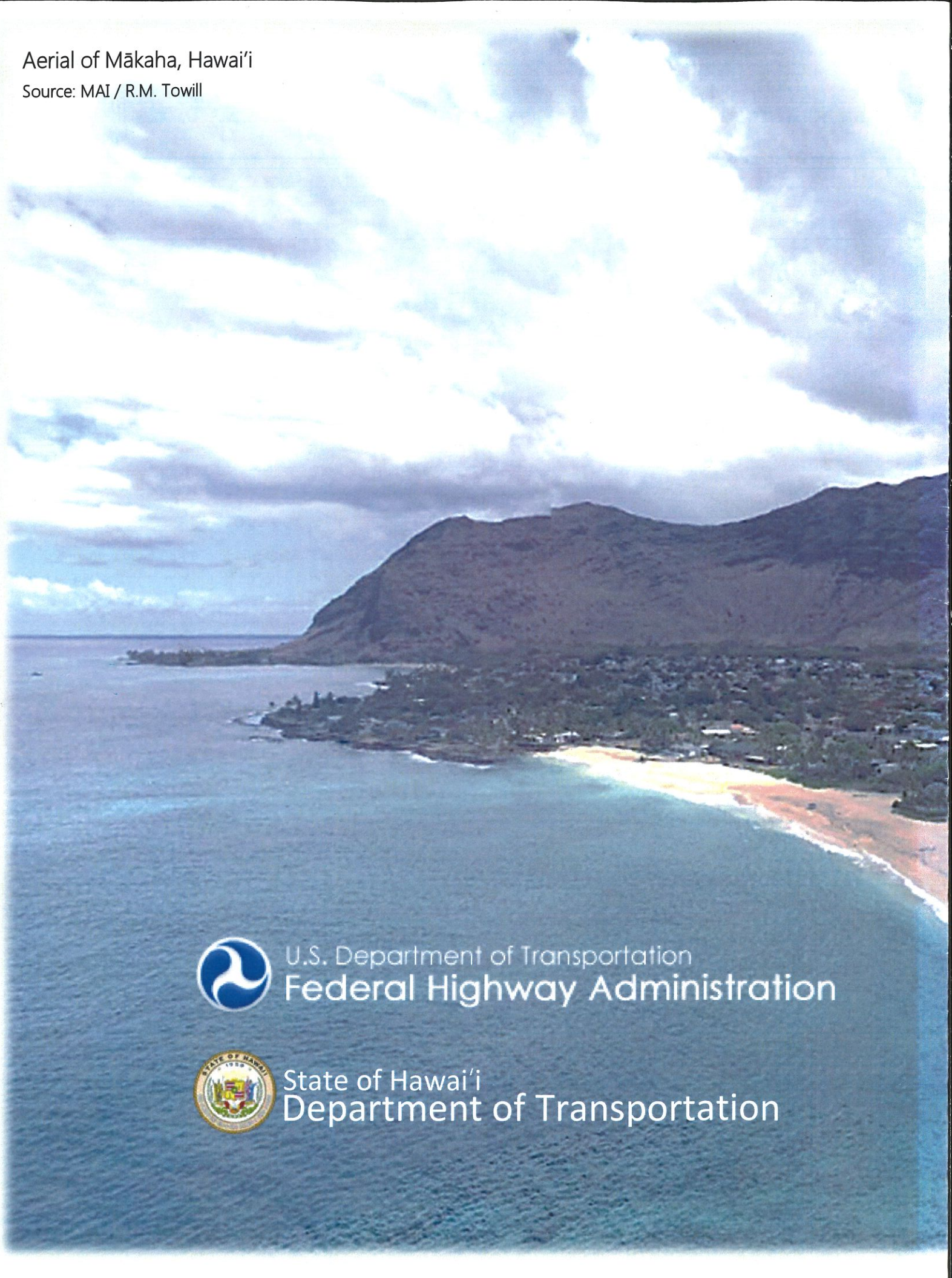
5. *High Chief A. Pākī*. (n.d.). Hawai'i State Archives. Retrieved from http://gallery.hawaii.gov/gallery2/main.php?g2_itemId=3389

6. *85-716 Farrington Highway/ Waianae Plantation Manager's House*. (n.d.). Retrieved October 10, 2017, from http://historichawaii.org/2014/03/03/85-716-farrington-highway-waianae-plantation-managers-house/

7. *The First Car in Honolulu with H. Baldwin* (n.d.). Hawai'i State Archives.

8. *Mākaha Bridge Aerial*. Retrieved October 10, 2017 from https://www.google.com/maps/@21.4665034,-158.2175848,2942m/data=!3m1!1e3?hl=en

9. *Chinn Ho*. (n.d.) Retrieved October 10, 2017 from https://www.freedommentor.com/chinn-ho-chinese-rockefeller-of-hawaii/



Aerial of Mākaha, Hawai'i
Source: MAI / R.M. Towill

U.S. Department of Transportation
Federal Highway Administration

State of Hawai'i
Department of Transportation