chapter 2

historical contexts
I. INTRODUCTION TO THE ISLANDS
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<th><strong>1890s</strong></th>
<th><strong>1900s</strong></th>
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<td><strong>BRIDGE STYLES</strong></td>
<td><strong>BRIDGE DRAT AILS</strong></td>
<td><strong>HAWAII EVENTS</strong></td>
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<td>Masonry (lava rock) arch</td>
<td>Steel &amp; wrought iron truss</td>
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<td><strong>1893</strong> Overthrow of Hawaiian monarchy</td>
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<td><strong>1894 – 1898</strong> Republic of Hawaii</td>
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<td><strong>1898</strong> United States annexed Hawaii</td>
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<td>1900 Organic Act abolished Department of Interior and replaced it with Office of Superintendent of Public Works</td>
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<td>1904 Territorial Gov’t advocated durable concrete bridges</td>
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<td>1905 Territorial legislature established</td>
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<td><strong>1909</strong> Rubble masonry (lava rock) parapet</td>
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<td>1911 Loan fund commission road width requirement of 18’ but 16’ was common in rural areas</td>
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<td>1910s</td>
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<td>• Bridges on belt roads designed by County Engineers Office until 1925</td>
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<td>• Notable people: J. H. Moragne (Kauai), En Leong Wung, and William Hoy Chun (Hamakua Coast, Hawaii)</td>
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<td>1920s Bridges were financed through loan fund and legislative appropriation</td>
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<td>1925 Federal Aid Program initiated</td>
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<td>1930s Bridges were financed through loan fund and legislative appropriation</td>
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<td>1932 – 1952 William R. Bartels tenure as chief designer with Territorial Highways Department marked shift to large deck girder and rigid frame bridges</td>
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<td>1937 Territory no longer matched incoming federal funds</td>
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<td>1941 Hawaii enters WWII</td>
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<td>1944 Federal Aid Highway Act</td>
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<td>1940s</td>
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<td>• Sidewalks added on both sides of many bridges</td>
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<td><strong>1942</strong> – Steel truss (Kauai)</td>
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<td>Lava rock masonry footings and abutments</td>
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<td><strong>1943</strong> – Side walls added on one side of bridge</td>
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<td><strong>1947</strong> – Concrete and steel shortage due to military construction for WWII</td>
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<td>BRIDGE STYLES</td>
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<td>METAL TRUSS &amp; STEEL STRINGER</td>
<td>1912-1953</td>
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<td>STEEL TRESTLE RAILROAD</td>
<td>1911-1963</td>
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<tr>
<th>BRIDGE DETAILS</th>
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<tr>
<td>1950 – 1953 Korean War</td>
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<td>1952 Nimitz Highway opened</td>
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<td>1956 Federal Aid Highway Act &amp; Highway Revenue Act</td>
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<td>1959 Hawaii admitted as 50th state of the United States</td>
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<tr>
<th>BRIDGE PHOTOGRAPH EXAMPLES</th>
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<td>1953 CONCRETE FLAT SLAB (KAAHOOLawe)</td>
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<td>1962 CONCRETE GIRDER (KAAHOOLawe)</td>
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<th>HAWAII EVENTS</th>
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<td>1950 State Department of Transportation established</td>
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<td>Interstate Highway System extended to State of Hawaii thus allowing Federal Interstate Highway Fund to be applied to Hawaii highway and bridge constructions</td>
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<tr>
<td>Construction of bridges and roads linked to needs of National Defense &amp; military establishment in the Pacific</td>
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<tr>
<td>Interstates H1, H2, and H3 were proposed to connect military bases on Oahu</td>
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| 1960 State Department of Transportation established |
| Interstate Highway System extended to State of Hawaii thus allowing Federal Interstate Highway Fund to be applied to Hawaii highway and bridge constructions |
| Construction of bridges and roads linked to needs of National Defense & military establishment in the Pacific |
| Interstates H1, H2, and H3 were proposed to connect military bases on Oahu |
II. DESIGN AND CONSTRUCTION OF BRIDGES AND ROADS IN THE HAWAIIAN ISLANDS, PRE-CONTACT TO 1960s

OVERVIEW

The Hawaiian Archipelago is a chain of rugged islands, coral reefs, and rocky shoals located in the North Pacific Ocean. The archipelago consists of approximately twenty islands and islets curving more than 1,600 miles southeast to northwest. The archipelago extends over a vast area of the Pacific Ocean, but has limited land area. This chain is crossed by the Tropic of Cancer and is located 2,100 nautical miles west of the mainland of the United States. The islands of Hawaii are the worn tops of volcanoes which first erupted from the bottom of the ocean millions of years ago. The land mass that makes up the Hawaiian Islands is comprised almost entirely of basaltic rock. Stream erosion, resulting from the island’s copious rainfall, and the constant action of the sea have carved large amphitheater-headed valleys and great sea cliffs, called pali, thousands of feet high in some places. This mountainous terrain drops steeply to a plain which slopes gradually to the shore. The steep mountains, deep valleys and circuitous coastline of the islands, have resulted in the completion of many dramatic bridge construction projects. The State of Hawaii is composed of eight principal islands; only the four largest (Hawaii, Maui, Oahu and Kauai) have the geography and population necessary for significant bridge construction. Due to the intensive development experienced in the Hawaiian Islands in the post-war period, few stretches of roadway retain a significant concentration of earlier historic bridges; the Hana Highway on Maui, Kuhio Highway on the north shore of Kauai and the Old Mamalahoa Highway on the Island of Hawaii with their numerous spans remain exceptions. The Pali Highway on Oahu has a significant concentration of historic bridges from the 1950s to 1969.

HISTORICAL BACKGROUND

Hawaii’s socio-political history may be divided into five general divisions:

1. Polynesian (Pre-western contact; 500 AD. to 1778).
2. European Discovery (1778 - 1810).
3. Hawaiian Monarchy (King Kamehameha 1810 to Queen Liliuokalani 1893).
5. Statehood to present (1959 – present)

Initially, road and bridge-building in Hawaii developed in conjunction with the westernization of the islands in the early nineteenth century. Examination of the archival materials and government documents of the Hawaiian Kingdom reveals very limited information. Considering the dramatic social and political upheavals of Hawaiian history, it is not surprising that few early records about bridge building were retained. After the overthrow of the Hawaiian monarchy in 1893, the Independent Republic of Hawaii looked to the United States for annexation and Hawaii became an American territory in 1898. Several bridges remain from this transitional period, including masonry arches built by the Republic of Hawaii – such as the Mamalahoa-Kalalau, Mamalahoa-Kaumoalii, and Mamalahoa-Laupahoehoehoe Bridges on the Island of Hawaii. The majority of the remaining historic bridges in Hawaii were constructed by the county and Territorial governments. Hawaii achieved Statehood in 1959, resulting in a shift in policy and procedure for highway and bridge construction throughout the state.
BRIDGE AND ROAD CONSTRUCTION IN THE KINGDOM OF HAWAII TO 1893

NATIVE ROADS (PRIOR TO 1810)

Traditionally, the Hawaiians had highly developed canoe-making and paddling skills, and the preferred means of travel was by water. Although there are few direct accounts by early Hawaiian informants discussing pre-contact trails or roads, physical evidence of a rudimentary native trail system remains. In addition to native footpaths constructed parallel to the coastline, there were less traveled routes to the uplands within each ahupuaa (a pie-shaped native land division stretching from the mountains to the sea) and shortcuts over the mountains. Occasionally, more substantial roads were built by Hawaiian chiefs for warfare and as a symbol of their unifying power, including the “King’s Highway” near Makapuu Point on Oahu and Maui’s Kiha-a-Piilani “Highway” which ran all the way from Wailuku to Hana, a distance of approximately sixty miles. The latter was laboriously constructed of hand-fitted, adze-trimmed basalt blocks about two feet on a side, and laid in a mosaic to form paths four to six feet wide. There is no remaining evidence of ancient Hawaiian bridge construction, although carved steps which may date from pre-contact Hawaii are found on several valley walls, such as those adjacent to the Koukouai Gulch Bridge in Kipahulu, Maui.

KINGDOM OF HAWAII (1810 to 1893)

Prior to 1846, the islands lacked a comprehensive system of interior roads or paths which made overland travel difficult and necessitated travel by sea. The Reverend Titus Coan, an early missionary, wrote “for many years after our arrival (in 1835) there were no roads, no bridges, and no horses... and all my tours were made on foot.”⁴⁰ A typical highway was “a simple trail, winding in a serpentine line, going down and up precipices, some of which could only be descended and ascended by grasping the shrubs and grasses.”⁴¹ Reverend Coan went on to enumerate the several ways he used to ford the streams and rivers; these included wading, jumping from rock to rock with the help of a stick, riding the shoulders of a strong Hawaiian, throwing a rope to the other side, and holding on to the shoulders of a chain of Hawaiian men stretched across the water.

The introduction of horses to the islands in 1803 aided land transportation. By the mid-nineteenth century, the increasing use of horses and wagons necessitated a better system of interior roads. In 1846, the Kingdom of Hawaii established the Department of the Interior with a Superintendent of Internal Improvements (later Public Works) to oversee the construction and maintenance of piers, harbors, government buildings, roads, and bridges. The expenditures of the Bureau of Internal Improvements or of the Department of the Interior as a whole were, with only a few exceptions, the largest item in the Kingdom’s budget. The governors of the various islands were charged with carrying out the king’s wishes by using prisoners or those liable for the labor tax. This tax required all able-bodied male Hawaiians who were “vassals or tenants of a landlord or without an art or profession” to work on any of the king’s road or bridge projects on certain designated days or to pay a commutation fee of 12 1/2 cents per day.⁴² However, the Kingdom’s road building, according to noted historian Kuykendall, consisted of little more than clearing a right of way, doing a little rough grading and putting up wooden bridges which were routinely washed away during heavy rains. Most of the Kingdom’s scarce funds were absorbed by the repair and maintenance of existing roads.

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⁴¹ Ibid., 31-32.
⁴² Patricia Alvarez, “A History of Road and Bridge Development on the Island of Hawaii” in Historic Bridge Inventory and Evaluation: Island of Hawaii and a History of Road and Bridge Development on the Island of Hawaii, Prepared for the State of Hawaii Department of Transportation Highways Division in cooperation with the U.S. Department of Transportation Federal Highway Administration, Honolulu, 1987a, 8.
Historian Ralph Kuykendall faulted the government for “the lack of general understanding of the importance of good roads, the lack of over-all planning and co-ordination between different districts, the lack of engineering skill and competent supervision, and the lack of funds with which to finance a thorough-going road program.” These conditions prevailed until the last decades of the nineteenth century. As late as 1886, Minister Charles Gulick had to admit:

A country like ours, for the most part mountainous and cut by deep gorges, which in the wet season are filled with impossible torrents, and widely separated districts with sparse population, present at a glance the most prominent difficulties in the way of substantial road making in this Kingdom. In other words, to speak comparatively, we have a hundred dollars’ worth of work to be done and, say, ten dollars to do it with. This general condition has not materially changed since the first public highway was built in the kingdom...  

In 1887, King David Kalakaua transferred much of the Kingdom’s responsibility for internal improvements to local road boards financed by a road tax. These boards were semi-autonomous and charged with the construction of public highways in their taxation districts. Generally, road construction was undertaken by prisoners and day laborers. The public works system of the Hawaiian Kingdom remained undisturbed by the overthrow of the monarchy in 1893, and no major changes were noted until the time of annexation by the United States in 1898.

THE FIRST BRIDGES (1840-1893)

The first reference to bridge construction, over the Nuuanu Stream along the present Beretania Street in urban Honolulu, appears in 1840. In an article describing “Improvements and Changes in and about Honolulu,” The Polynesian reported:

Then we leave Rev. L. Smith’s new church [Kaumakapili Church, then located on Beretania Street between Maunakea Street and Nuuanu Avenue]... with a causeway, crossing the river and low ground in the vicinity. [The bridge’s] expense exceeded $1200, and it has proved of great utility, being a great thoroughfare... instead of the long ride through the water as was formerly the case.  

Other bridge construction projects followed quickly, although none of these early bridges remain today. In 1845, the first published annual report of the Minister of the Interior noted that “some improvements have been made on the bridges and roads of [Oahu] and other islands.” Timber and stone were the prevailing bridge construction materials at this time. Stone was abundant in Hawaii, and among the first bridges built by the Department of the Interior were stone bridges at Nuuanu and Waikiki. But construction of stone bridges required skilled labor, which was scarce in the islands. Wood was the cheapest material and many types were available. R.A.S. Wood, the Superintendent of Internal Improvements in the mid-1850s, evaluated the types of wood used in a report to the Minister:

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44 Biennial Report of the Minister of the Interior to the Legislative Assembly of 1886, Hawaii (Kingdom), Department of the Interior (Honolulu: P.C. Advertiser Steam Print, 1886), 16.  
45 The Polynesian (Honolulu), October 17, 1840, 74.  
46 Biennial Report of the Minister of the Interior to the Legislative Assembly for the Year Ending May 21st, 1845, Hawaii (Kingdom), Department of the Interior (Honolulu, 1846), 10.
The bridges heretofore built by the government prove beyond all doubt the unworthiness of Oregon pine or fir timber for this purpose. All, with scarcely an exception, are in such a state of decay as to require rebuilding. Our own ohia [a native hardwood], for bridge or wharf purposes, is infinitely superior to Oregon pine. Though somewhat more expensive at the first outlay its durability will warrant using it.47

These pioneering bridges were unfortunately vulnerable to floods. On April 1, 1847 heavy rain storms struck Kauai and “all the bridges on the island were carried away.”48 Within the week Oahu suffered the same fate. In 1858, the Oahu Road Supervisor reported that nine bridges were destroyed in his district by a freshet. Twenty years later, the Report of the Minister of the Interior to the Legislative Assembly noted that “the bridges of Hawaii and Kauai were swept away last year.”49 The 1882 Department of the Interior Report carried the lament that “in some districts, owing to the exceptionally wet season, causing heavy freshets in the streams, a good many bridges have been carried away.”50

In an attempt to provide low-cost, permanent replacements for timber bridges, ten steel Pratt-truss bridges, manufactured by the Pacific Bridge Company in Portland, were ordered by the Kingdom for the Island of Hawaii as early as 1884. For shorter spans, concrete slabs were the preferred solution, but at this date, concrete bridges that could achieve longer spans were beyond the available engineering and construction technology. Nonetheless, maintaining steel bridges proved too costly in Hawaii’s corrosive marine environment and they were soon rejected for government roads. None remain from this early steel period.

BRIDGE AND ROAD CONSTRUCTION IN HAWAII: 1894 to 1941

BRIDGE CONSTRUCTION DURING THE REPUBLIC OF HAWAII (1893-1898)

During the period of the Kingdom, road and bridge construction was undertaken by day laborers and prisoners. However, in 1896-97, contracts were let for a belt road on the Island of Hawaii, the first time such a system was used extensively, resulting in the construction of hundreds of miles of roads on that island. The masonry (cut basalt or lava-rock) arch spans constructed along the Hamakua coast of the island of Hawaii under these contracts are the oldest remaining bridges in the islands. Other significant nineteenth-century bridges include the Opaekaa Stream Bridge which was built from portions of one span of a three-span bridge manufactured in Scotland in 1890 and erected over the mouth of Kauai’s Waialua River in 1896. This bridge is significant as the only known British-made iron bridge in the United States and was listed on the National Register of Historic Places in March 1983.

BRIDGE CONSTRUCTION DURING THE EARLY TERRITORIAL PERIOD (1898-1924)

The Hawaiian Islands were annexed by the United States in 1898. The Organic Act of 1900 abolished the Department of the Interior and replaced it with the Office of the SPW, which had responsibility for expending territorial funds on road and bridge work. Five years later, the Territorial Legislature established the county governments on the separate islands, granting them taxing and spending powers in their jurisdictions. After the counties were granted independent taxing powers, they still relied on legislative appropriations to supplement

47 Report of the Minister of the Interior to the Legislative Assembly, Hawaii (Kingdom), Department of the Interior (Honolulu, 1855), 9.
48 The Polynesian (Honolulu), April 10, 1847, 191.
49 Report of the Minister of Finance to the Legislature of 1878, Hawaii (Kingdom) (Honolulu, 1878), 10.
50 Report of the Minister of the Interior to the Legislative Assembly, Hawaii (Kingdom), Department of the Interior (Honolulu, 1882), 49.
county funds for internal improvements, thus the history of county road-building was closely tied to Territorial and Federal government largesse. Consequently, throughout much of the early twentieth century, the counties’ road and bridge-building could not keep up with the islands’ economic development and infrastructure needs. In some cases, government funds were so scarce that public roads were maintained by private business so as not to impede their productivity. For example, the belt road on the windward coast of Maui was maintained by the East Maui Irrigation Company and the roads in Haiku, Maui were maintained by the Haiku Fruit and Packing Company. Increased automobile traffic and damage from heavy rains increased the maintenance cost of these roads and in the 1920s, private planters demanded that the county administration shoulder the burden of the road upkeep.

In response to a chronic shortage of funds for road construction, the 1911 Legislature recommended the issuance of territorial bonds for belt road construction. A Loan Commission, consisting of the SPW, the county Chairman of the Board of Supervisors, and three county residents, was appointed to oversee the fund expenditures. In the 1920s and 1930s, bridge building continued to be financed through the loan fund and legislative appropriation. Prior to the initiation of the Federal Aid Program in 1925, bridges along the belt roads were generally designed by the county engineers using Territorial Loan Funds. Each county had its own bridge design department located within the County Engineer’s Office. Many of the bridge engineers were technologically skilled and evidenced high aesthetic sensitivity. J. H. Moragne, on the Island of Kauai, was responsible for the most technologically innovative work of his time. En Leong Wung and William Hoy Chun of the County of Hawaii designed scores of technologically simple, yet aesthetically sophisticated, bridges along the Hamakua Coast of that island. These bridges were generally short span reinforced-concrete arch, deck girder or flat slab structures.

As horses and carriages gave way to automobiles, trucks, and buses, wider and more durable roads were needed to service these vehicles. Originally, bridges were just wide enough to let one horse and buggy cross at a time and no sidewalks were provided for pedestrians, even in urban areas. A Hilo newspaper writer pointed out that “strictly speaking, a pedestrian has no rights which any one is bound to respect.” Bridges on plantation roads were often as narrow as eight or nine feet, those on public roads averaged fourteen or sixteen feet in the first decade of the century. The Loan Fund Commission established eighteen feet as its required road width in 1911, although sixteen feet was commonly used in rural areas. These specifications prevailed until the 1920s when they were expanded to twenty feet. Sidewalks were generally not added until the 1930s, first on one side, then on both sides by the end of the decade.

Bridge railings are another indication of a bridge’s period of construction. The earliest bridge railings were rubble masonry (lava rock) constructions, such as those at the Mamalahoa-Kalalau Bridge built on Hawaii Island in 1899. These were followed by simple concrete railings, or parapets, which were generally less than three feet high and capped on top. Examples of these earliest parapets include the Mamalahoa-Puuokalepa Bridge on Hawaii Island, and the Waioli and Waipa Bridges on Kauai. Decorative rectangular inset panels were added to concrete parapets by 1919, such as those of the Waikamoi and Haipuaena Bridges on Maui. In the 1920s, railings became post and beam constructs, usually with a rectangular configuration, such as those found on many of the county-built bridges along the Hana Highway. Occasionally, the railings rose to an artistic level with Italianate posts, such as the Ainako Stream-Waianuenue Avenue Bridge in Hilo. Block-like end piers were added in the 1930s, smaller versions of the decorative pylons which appear on the continental United States bridges of this period. These were typically found on Federal Aid bridges constructed by the Territory of Hawaii. Art Deco motifs and streamlined design, like those found on the Date Street Bridge in Honolulu, were also common to 1930s-era bridges.

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51 Alvarez [1987a], 63.
From 1900 to 1940, the Hawaiian Islands witnessed rapid economic and population growth. During this time, the population of the islands more than doubled, primarily due to the importation of laborers for the sugar and pineapple plantations, which meant increasing demand for housing, schools, utilities and physical infrastructure. Only the remote rural areas traditionally isolated by a lack of good roads, such as the Hana district on Maui, Waipio Valley on the Island of Hawaii or Kalalau on Kauai, witnessed a decline in population during this period. The construction of the Panama Canal in 1914 coincided with changing social conditions in Hawaii. Honolulu was eager for the expected economic growth through shipping, trade, and tourism. These prospects mobilized community leaders to increase promotion for Hawaii, improve transportation, and further identification between Hawaiian communities and American cities. The World’s Columbian Exposition in Chicago in 1893 served as the inspiration for the City Beautiful movement and the ensuing neo-classical revival in the United States. The City Beautiful movement reached its height on the U.S. mainland between 1900-1910, but affected Hawaii somewhat later. This movement is characterized by an attempt to create beautiful and functional cities. Aesthetic principles such as beauty, order, system, and harmony found physical realization in urban design. Architecture and public works projects, such as road and sewer systems, became civic statements which strengthened the identification of Hawaii to the U.S. mainland. The improved physical environment would persuade urban dwellers, many of them recent immigrants to Hawaii from Asia, to become imbued with civic patriotism and better disposed toward community needs.

During this period, Hawaii was on the receiving end of mainland technology and the history of its bridge development parallels that of the United States mainland, albeit with some delay. As on the mainland, there was an evolution of bridge types constructed due to changing economic factors and technology. Records for length and sophistication of design were continuously changing; accolades such as “the longest” and “the first” were used repeatedly over the decades to describe the latest achievements.52 Although Hawaii lagged behind the mainland United States in technological development, it still had its share of landmark and historic bridges.

The bridges constructed with Territorial Loan Funds are among the early examples of the progressive Territorial Highway system in Hawaii. These bridges are also an example of one of the first uses of formal engineering expertise in bridge making by the new territorial government after the annexation of Hawaii by the United States. The bridges played a major role in the development of each county’s belt road plan which connected previously isolated communities with a paved highway and a series of steel-reinforced concrete, timber, or steel bridges. The construction of improved modern vehicular roads, especially the up-to-date replacement of older, weak timber bridges by steel truss and reinforced concrete spans, remedied unsatisfactory road and transportation conditions, improved communications, and helped stimulate the economic and social growth of the then relatively isolated communities. The new roads and bridges shortened distances connecting each island’s villages, farms and plantations. Supplies, services, and scenic and recreational areas were reached more easily, and the improved transportation stimulated new competition with shipping at each coastal town’s pier and landing.

Homesteading, another important movement in Hawaiian history, was also intended to create smaller communities in Hawaii.53 After the overthrow of the Hawaiian monarchy in 1893, the new provisional government leased out vast tracks of prime government land to sugar plantations. When these thirty-year leases expired in the 1920s, the territorial government made this land available for homesteaders. The counties began to develop new lands for homesteading by installing the needed infrastructure, such as roads and utilities. Construction of roads and bridges was limited by the small and intermittent funding mechanism of assessing homesteaders as they bought the lots. The SPW remained responsible for homestead roads and bridges until 1917 when the responsibility for homestead

53 Spencer Mason Architects, Historic Bridge Inventory: Island of Kauai, prepared for the State of Hawaii, Department of Transportation, Highways Division in cooperation with the U.S. Department of Transportation, Federal Highways Administration (Honolulu: 1989), 249.
roads was transferred to the Territorial Commissioner of Public Lands (CPL). In actuality, the County Engineer’s Offices remained responsible for the construction of most of the roads and bridges until 1925, because the CPL was “not provided with an engineering force necessary for the direct handling of this work.”

**BRIDGE CONSTRUCTION AND THE FEDERAL AID PROGRAM (1925-1941)**

The Federal Aid Highway System in Hawaii consists of three types:

1. the Interstate and Defense Highways;
2. the Federal Aid Primary System; and
3. the Federal Aid Secondary System.

Beginning in 1916, in anticipation of its entry into World War I, the United States Congress appropriated funds to assist States in developing their transportation networks. Federal Aid funded roads were intended to upgrade existing highways by providing good drainage, clearly marked lanes, improved alignment, grades that could be negotiated in high gear, wide shoulders, safe and wide bridges, and safe bridge approaches. Belt roads, which circled the island, or roads that linked a seaport to federal property (such as military bases or national parks) were usually selected for Federal Aid in Hawaii. Maintenance of federal roads was to be done by the States from their own funds. Because it was not yet a state, Hawaii was initially excluded from the Federal Aid system although its citizens paid federal taxes. The Hawaiian Legislature passed a Bill of Rights in 1923, demanding equal benefits with the nation’s States; this bill was signed into law by President Calvin Coolidge in March 1924.

Hawaii received its first federal funds in 1925 and created the THD to oversee the expenditure of the funds as required by the Federal Road Aid Act. Designs for new bridges on designated Federal Aid primary roads were hereafter prepared by this department. Also in 1925, Congress voted to give Hawaii the federal highway funds it had missed since 1917. In the mid-1930s, yearly federal contributions rose to the million dollar mark with the passage of the New Deal road aid measures such as the National Industrial Recovery Act, the Emergency Relief appropriations Act and aid for secondary road systems. By 1940, approximately sixty-five percent of Hawaii’s roads had been built with federal funds.

Bridges were a special concern of the federal highway system, and the THD began a systematic replacement of narrow and hazardous bridges. With ample funds, the THD began to straighten out the belt roads and build long, high bridges across the mouths of the valleys. The federal government started funding secondary or feeder roads in the late 1930s. These were required to be outside of municipalities and be farm-to-market roads or other rural roads of community value which connect with important highways or the Federal Aid primary system. Bridges constructed with Federal Aid dollars have longer spans and were more decorative than county financed bridges. Reinforced-concrete tee beam bridges dominate this period, although a few rare examples of open-spandrel concrete arches remain. Rail design was standardized into a few patterns, such as the “Greek-cross void”, enabling easy recognition of THD bridges. Notable examples include the Hanapepe Highway Bridge on Kauai and the Kipapa Franklin Delano Roosevelt (FDR) Bridge on Oahu.

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54 Ibid., 4.
BRIDGE AND ROAD CONSTRUCTION IN HAWAI I: 1941 to 1960s

BRIDGE CONSTRUCTION DURING WORLD WAR II AND THE POST-WAR PERIOD AND THE NATIONAL DEFENSE HIGHWAY SYSTEM (1941-1960s)

After the outbreak of World War II in December 1941, the military constructed many miles of roads in Hawaii. However, as a Territory of the United States, Hawaii was not entitled to the same level of federal funding given to other continental States for highway building projects, based on the 1944 Interstate Highway System Act. In 1941, the War Department designated all Oahu’s principal highways as part of a “strategic network of highways.” The term “strategic network of highways” implicates principle highway traffic routes were of military importance in the Territory of Hawaii. Civilian construction virtually halted as manpower and equipment was requisitioned by the military. The military establishment quickly became the largest employer of civilian workers in the Territory. Highway and bridge construction was restricted to only those projects which materially aided the National Defense System.

Hawaiian delegates used the Department of Defense’s designation as “strategic” to argue that Hawaii’s military bases and highway networks were key to National defense. In the early 1960’s, the Korean War increased National Defense activity in Hawaii due to rising tensions in the Pacific area. This need, as well as the increased use of motor vehicles and the islands’ tourism industry collectively increased pressure to meet growing transportation needs. In 1956, Territorial Highway Engineer Ben E. Nutter provided a “Progress Report on Highways” to the Legislature that detailed highway deficiencies in excess of 50 million dollars - or more than ten times the annual construction budget. The report indicated that the 1954 Hawaii Federal Aid Highway System was still about 10 years behind in providing modern highways of adequate design and capacity. In the post-war era a sophisticated survey of the island’s roads was completed by the THD. This survey rated roads and bridges on a mathematical “sufficiency rating system.” Fewer than half of the Federal Aid system’s roads got a passing grade.

In 1959 Hawaii was admitted as the fiftieth state of the United States. The "Hawaii Statehood Transition Bill" of 1959 made millions of federal dollars available for highway improvement and development. The HDOT was established in January 1960. At that time, there were about 633.93 miles of roads to build to fill the gaps in the Federal Aid Highway System. Later, in July 1960, the Interstate Highway System was extended to the State of Hawaii, which allowed the new Federal Interstate Highway fund to be applied to Hawaii’s highway and bridge constructions. With Hawaii’s significant role in the National defense system, the Interstate Highway fund was intended to serve both military needs and civilian interstate traffic needs. Hawaii continued to benefit from regular federal aid, such as the Highway Beautification Act of 1965 and aid for secondary roads.

The construction of roads and bridges in Hawaii can be directly linked to the needs of the National Defense system and the military establishment. With adequate federal funds in the post-war era, bridges were usually built as part of large public projects, such as for the construction of new Nimitz Highway and H-1, Trans-Koolau Range projects, and the Seismic Wave Damage Rehabilitation Project. These projects played an important role, tying together military bases and civilian residential districts settled all over the islands. Bridges of this period can be easily recognized by the distinctive post-war style railing, the prevailing decoration for bridges at the time. This railing style is composed of a reinforced concrete balustrade penetrated with horizontal rectilinear voids with concrete rail caps. Other bridges from this period began the first use of metal in guardrail designs. However, during the implementation of these federally sponsored projects, many earlier, historic bridges were demolished and replaced by modern constructions.

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III. THE HANA HIGHWAY, MAUI: PRE-CONTACT TO 1960s

HISTORICAL BACKGROUND

Before about 1450AD, Maui was divided into two separate kingdoms, one with a court at Lahaina and one with a court at Hana. The two were constantly at war, but eventually Piilani of the Maui Ulu line at Lahaina conquered the east and south parts of the island. His rule is remembered as one of peace, prosperity, and the construction of public works, including the largest heiau, or temple, in the Hawaiian Islands. Called Piilanihale, it was built near Honomaele and incorporated massive yet un-mortared stone walls, some up to fifty feet high, as well as an immense stone platform covering nearly five acres. Of greater importance to his reign and to his subjects was the creation of a network of unpaved roads extending throughout Maui, a process that symbolized his unifying power. Each road was laboriously constructed of hand-fitted, adze-trimmed basalt blocks about two feet on a side, and laid in a mosaic to form paths four to six feet wide. One of these roads ran all the way from Wailuku to Hana - a distance of approximately sixty miles. In circa 1490AD, Piilani's son, Kihaapiilani, had the road extended beyond Hana, through Kaupo Gap, and across Haleakala Crater.

The original route to Hana was well maintained for over 250 years, because it was the only land link between the two ends of the island. Around 1759, the king of the Big Island, Kalaniopuu, captured Hana and held it for more than twenty years. During this time, the road fell into disrepair and was purposely closed to thwart incursions from the north. Nonetheless, in about 1780 Kahekili, the King of north Maui (or Maui iki) retook Hana and reopened the road, which by then needed extensive repairs. Not only was the road cleared, but where stream canyons were deepest wooded bridges were built to replace the old, treacherous staircases painstakingly carved into the cliffs centuries prior. Even so, the roads could support no more than foot traffic, and much of it served that function until 1900, though by then Hana had become a thriving sugar plantation community.

In 1848 Kamehameha III declared the Great Mahele, releasing one third of all Hawaiian lands to the common people. Foreigners were allowed to own private property in the islands for the first time. Among them was George Wilfong, a Caucasian sea captain. He capitalized on the needs of the 1849 California gold rush miners by planting sixty acres of sugar cane in Hana, harvesting it with exploited local laborers, and milling it with contract workers in nearby Kauiki. All of the sugar was shipped from Hana Bay, and despite the booming business, there was still no substantial overland trading between the north and south parts of Maui. Prior to this enterprise Kipahulu and its adjoining districts of Hana and Kaupo had retained their traditional Hawaiian culture.

In 1877 fifteen miles of unpaved road was constructed from central Maui to Kailua in order to build the Haiku Ditch, a remarkable engineering feat that watered new cane land on the central Maui plateau. In 1899 the Nahiku Rubber Company planted thousands of experimental rubber trees on the makai (toward the ocean) side of the old road. This enterprise pushed the unpaved road another fifteen miles to Nahiku. East Maui's potential tourism value gave the county a strong incentive to promote the idea of a belt highway to Hana. As early as 1900 the Maui News editorialized in favor of a good wagon road connecting Hana and central Maui. This prompted the building of the first stretch of improved roadway, which followed the old road from Keanae to Nahiku, in 1900. The ancient footpath was widened to sixteen feet, to accommodate horse-drawn wagons, and was surfaced with cinders. Because of the extreme difficulty of the terrain, however, its cost was prohibitive and the roads were inadequate for frequent automobile traffic. The 1905 SPW report stated that “very rough country is encountered in these districts.
On account of the great expenses of road construction, the road has been made as narrow as possible in order to construct, with the money available, the maximum length of road.\textsuperscript{56}

The new road segment functioned so well that there were soon calls to extend it from Kailua all the way to Kipahulu, well past Hana. The Territorial Legislature however, was unimpressed and in 1903 refused to fund the project. Undaunted, commercial entrepreneurs from Paia to Hana lobbied the legislature heavily, resulting in yet another section being improved, from Kailua to Keanae in 1904. This stretch met significant construction problems, including jungle encroachment, torrential streams and landslides, all of which doubled the original $50,000 cost.

Between 1905 and 1908 concrete bridges were built in the ditch country near Nahiku. Bridge building on Maui surged in 1911, when the Territorial Legislature established a Loan Fund Commission to oversee a special fund for belt roads. Out of the $1,270,000 appropriated by the Commission in 1911, Maui received $370,000. This made possible the building of twenty-one Maui bridges: four on the Hana Belt Road, four on the Piilani Highway south of Hana, six in the upcountry district, six in Central Maui and one in West Maui. Work on the belt road continued depending on the extent of funding. A narrow road with several bridges was built from Kailua to Keanae by 1912 with territorial funds. From Hana, contractors Wilson and McCandless had completed the Nahiku-Keanae section of road by 1915. This road did not link up with the Kailua extension, but instead dead-ended in the Koolau Forest Reserve. The lack of a continuous paved road prompted one Maui legislator to complain that “Maui is the only island on which you cannot traverse by road around it.”\textsuperscript{57}

In 1914, inspired by the dramatic expansion of the sugar industry at Hana, the County of Maui Board of Supervisors unanimously agreed to press the Territorial Legislature for funding to improve the rest of the old road at least as far as Kipahulu and entertained ambitions to eventually circle the entire island. The road to Hana became part of a grander vision, called the Belt Road. Unfortunately, Territorial Governor Lucius Pinkham was adamantly opposed to the project, and consequently it took until 1923 before belt road planning was resurrected and modifications to the ancient route were given serious consideration.

Until this time, the journey to Hana was made partly over unpaved wagon roads and horse trails, often rendered impassable by damage from frequent rains. An alternative route through the island’s south side took the traveler through the drier ranch country ending at Kipahulu. Since both land routes were arduous and slow, the most common means of travel to Hana was by steamer ship. Writer Robert Wenkam states that:

\begin{quote}
When Hana was without a road, and the coastal steamer arrived on a weekly schedule, Hana-bound travelers unwilling to wait for the boat drove their car to the road’s end at Kailua, rode horseback to Kaumahina ridge, then walked down the switchback into Honomanu Valley. Friends carried them on flatbed taro trucks across the Keanae peninsula to Wailua cove. By outrigger canoe it was a short ride beyond Wailua to Nahiku landing where they could borrow a car for the rest of the involved trip to Hana. Sometimes the itinerary could be completed in a day. Bad weather could make it last a week.\textsuperscript{58}
\end{quote}

\textsuperscript{56} Report to the Governor, Territory of Hawaii by the Superintendent of Public Works or the Year Ending June 30, 1905, Hawaii (Territory), Department of Public Works (Honolulu, 1905).

\textsuperscript{57} “Roads First Need View of Fassoth,” Maui News (February 11, 1921).

\textsuperscript{58} Robert Wenkam, Maui: the Last Hawaiian Place (San Francisco: Friends of the Earth, 1970), 65-66.
He adds:

The road was little more than a wide mud and gravel path for many years until paved by a young Hawaiian contractor, Johnny Wilson, who later became Mayor of Honolulu. Even when paved, mudslides plagued the road. The Keanae Chinese store offered overnight rooms to stranded motorists at first, but later it became accepted practice to wait at the mudslide for a car to appear from the opposite direction, then slosh across the intervening gap and offer to exchange cars with the complete stranger on the other side. A handshake would make the temporary trade official, and both parties would agree to meet the next day when the mud had been removed by county work crews, who usually arrived on horseback within a few hours.

Ranchers from the other side of the island also benefited by the road. The ranchers and their friends knew the land well from horseback, but the automobile offered a much easier way to treat guests to a grand tour of the Hana coast. A one-day trip was now possible and small hotels in Hana began receiving their first tourists. The Hana road soon earned a reputation of its own - not as a road to go somewhere on, but as a destination in itself.\(^{59}\)

By 1922 Hana was the site of the large Kaeleku sugar plantation and mill. The plantation’s manager, Mr. Joseph Herscherr, favored the proposed Hana Belt Road as “a wonderful tourist asset.” Most of Maui’s business interests also favored the construction of a road to Hana but disagreed about the route and means of financing.\(^{60}\) County Engineer A.P. Low estimated in 1923 that the Hana Belt Road would cost about $692,000. Citing the highway’s high cost, Maui businessman A.F. Tavares instead urged funding for a less expensive Kipahulu-Kaupo belt road around Maui’s south side. But Maui businessmen objected to all financing proposals which included either county bonds or a special road tax.

Despite its prohibitive cost, the county eventually decided to complete the paved road to Hana. In May 1923, a total of $50,000 was appropriated from the Territorial Legislature for road work, despite the fact that less than twenty years earlier an equal amount had proved inadequate for a much shorter length of road, and that an additional $200,000 had been needed to overcome similar construction difficulties. The more heavily traveled sections from Keanae to Paia, were at least partially paved by 1926, but farther south the road remained unpaved. The worst of the construction problems lay ahead, between Kailua and Kopiliula Falls. Here, the earth would not cooperate as easily as farther north because of a drastic change in soil conditions. The surface soils are highly organic and unstable, so that even very minor roadway excavations trigger mud slides. In July 1926, a massive landslide covering more than thirty acres halted further work. Floods during the winter of 1926-27 washed out embankments constructed not two months earlier. Overruns associated with the already constructed portions left the Territorial Legislature in no position to continue funding the road. Despite these obstacles, Federal Aid funds were made available to Hawaii in 1925 which provided the necessary relief, and the project pushed its way towards Hana.

To lower costs, the county administration established a prison camp at Keanae, and pressed the hardest criminals into road gangs that eventually turned the remaining barely passable trails leading to Hana into a cinder-paved highway that could handle trucks and cars. Following the road’s completion, a celebration was held, one that included a great luau and exuberant schoolchildren waving small American flags and marching down to the old cannery site on Hana Bay.

\(^{59}\) Ibid.

\(^{60}\) “Belt Road Bonds Can Be Taken Up,” *Maui News*, May 5, 1922.
Keeping the road maintained and open, especially along the perilously unstable area between Nahiku and Kaeleku, was a major undertaking. The Territory, and later the state, hired numerous residents in and around Hana as seasonal workers dedicated to repairing the damage wrought by mud slides, rockfalls, downed trees and erosive floods. Makeshift bridges, often composed of inferior materials, were continually washed out. Forces were enlisted to maintain the road to Hana on a routine basis, and the remaining early wood bridges were replaced by the present-day reinforced concrete bridges. Even so, most of the road remained unpaved or only nominally surfaced. Road construction and maintenance was a fact of life for Hana residents:

_The territorial and, later, state departments of transportation became major employers, supplying cash-jobs residents needed to augment their subsistent lifestyles. The county or state remained a major source of the jobs residents needed to augment their subsistent farming and ranching efforts. Men were anxious to work for the county or state road departments._

A boost for the roadway came in 1934, with the creation of the Hana Coast Civilian Conservation Corps, one of FDR’s job programs designed to combat the effects of the Great Depression. By 1940, the highway was substantially complete. In 1946, the Hana Ranch developed the first hotel in Hana to accommodate tourists who made the journey to this previously isolated community by road.

A journalist driving through the ditch country at the time called the Hana Belt Road a “paved trail following the line of the ditch through the wild jungle.” It wasn’t until 1962 that a reluctant state legislature, still in its infancy, agreed that the newly-created HDOT had to take responsibility for the care of the road. An unheard-of $2.2 million was allocated for widening, paving and restoring the highway from beginning to end. When the job was finished in 1964, the “highway” was at last negotiable by even the heaviest vehicles, at least in good weather. Since 1985, a well-planned maintenance program has preserved the road as one of Hawaii’s most scenic and treasured drives. Residents have resisted a major upgrading of the roadway since improvements would “result in a tidal wave of visitors and would destroy the fragile balance between being fed by tourism and being consumed by it.”

Today, the sixty-mile road to Hana from Wailuku, State Highway 360, offers residents and tourists alike one of the most spectacularly scenic automobile routes in Hawaii.

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62 “Writer Takes You Around the Isle - Maui This Time,” Honolulu Advertiser (Honolulu, HI), April 27, 1940.
63 Lueras, 81.
IV. THE OLD MAMALAHOA HIGHWAY, HAWAII ISLAND: PRE-CONTACT TO 1960s

HISTORICAL BACKGROUND

The Mamalahoa Highway takes its name from the edict of King Kamehameha, the great Hawaiian conqueror who united the Hawaiian islands. Mamala hōe (lit. “the way or law of the broken canoe paddle”), popularly known as the “Law of the Splintered Paddle”, guaranteed the safety of the highways to all travelers. During his travels on the Island of Hawaii, Kamehameha and his men came upon a fishing village in the Keaau region of the island; one of the fishermen, defending his territorial rights, hit the king with a wooden canoe paddle, shattering it into pieces. The king subsequently issued an edict that all men should be free to travel the roads of the islands unimpeded. An alternative interpretation suggests that Mamalahoa (lit. “law of the friend”) refers to the death of Kamehameha's guard at the hands of the king's supporters after failing to protect Kamehameha from the assault. The guard was killed by pulling a spear back and forth through his body, thus simulating the movement of a canoe paddle. Kamehameha, stricken by the death of his friend, consequently issued the famous edict. Kamehameha's edict established a precedent for contemporary state laws which ensure free access to areas traditionally accessible in pre-contact Hawaii, such as upland trails and coastal beaches.

The Old Mamalahoa Highway was built roughly along the route of an ancient Hawaiian footpath (Ala Kahakai) that was to become a nineteenth century horse trail. Pre-contact Hawaiians preferred travel by canoe; however, the coastal trails were used in bad weather and rough seas.

Historian Russell Apple suggests that the coastal trail was the path taken by the ancient Hawaiians during the Makahiki celebration. The annual Makahiki season, which runs approximately from October to February, was an event of major religious, economic, and political importance. During the Makahiki, the image of the god Lono was carried through each island district by priests, and offerings (some suggest “taxes”) were collected for the king.

In 1823 the Reverend William Ellis and his party were the first westerners to complete a circuit of the island of Hawaii. Ellis' journal, first published in Boston in 1825, chronicled this trip with detailed observations of geology, botany, population, social and religious customs, political structure, history and legends. Generally, Ellis' trip followed the Hawaiian Makahiki trail, although some portions, such as the rugged, ravine-cut section between Hilo and Laupahoehoe, were traversed by canoe.

In 1873, the Victorian traveler and writer Isabella L. Bird made the journey from Hilo to Waipio on horseback; she describes the trip in length in a series of letters written to her sister between January and August of that year. Leaving Hilo, she writes:

"The track crosses the deep, still Wailuku river on a wooden bridge, and then after winding up a steep hill... hangs on the verge of lofty precipices which descend perpendicular down to the sea, dips into tremendous gulches, loses itself in the bright fern-fringed torrents which have left their way down from the mountains... Then the track goes down with a great dip [after passing through the sugar plantation of Kaiwīki], along which we slip and slide in the mud to a deep broad stream... Our accustomed horses leaped into a ferry-scow provided by the Government... and leaped out on

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the other side to climb a track cut on the side of the precipice, which would be steep to mount on one's own feet.\textsuperscript{65}

Continuing beyond Onomea, where Isabella Bird stopped at the plantation of the Austin family, she describes her journey onto Waipio Valley on the north-east shore of the island:

\begin{quote}
The dimpling Pacific was never more than a mile from us as we kept the narrow track in the long green grass, and on our left the blunt snow-patched peaks of Mauna Kea rose from the girdle of forest... The track for twenty-six miles is just in and out of gulches, from 100 to 800 feet in depth, all opening to the sea, which sweeps into them in three booming rollers.

All the gulches for the first twenty-four miles contain running water. The great Hakalau gulch we crossed early yesterday, has a river with a smooth bed as wide as the Thames at Eton. Some have only small, quiet streams, which pass gently through ferny grottoes. Others have fierce torrents dashing between abrupt walls of rock, among immense boulders into deep abysses, and cast themselves over precipice after precipice into the ocean... A few are crossed on narrow bridges, but the majority are forded.\textsuperscript{66}
\end{quote}

Bird claims that the “worst pali of all [was] the south side of Laupahoehoe.” She states that “Mr. Brigham in his valuable monograph on the Hawaiian volcanoes... appears as much impressed with these gulches as I am.”\textsuperscript{67} She quotes Brigham in her journal:

\begin{quote}
The road from Hilo to Laupahoehoe, a distance of thirty miles, runs somewhat inland, and is one of the most remarkable in the world. Ravines, 1,800 or 2,000 feet deep, and less than a mile wide, extend far up the slopes of Mauna Kea. Streams, liable to sudden and tremendous freshnets, must be traversed on a path of indescribable steepness, winding zig-zag up and down the beautifully-wooded slopes or precipices, which are ornamented with cascades of every conceivable form. Few strangers, when they come to the worst precipices, dare to ride down, but such is the natures of the rough steps, that horse or mule will pass them with less difficulty than a man on foot who is unused to climbing. No less than sixty-five streams must be crossed in a distance of thirty miles.\textsuperscript{68}
\end{quote}

After leaving the area north of Laupahoehoe, Bird happily claims: “There are no large gulches on today's journey. The track is mostly through long grass, over undulating uplands...”\textsuperscript{69} Forty years later, in 1913, after the establishment of the Territory of Hawaii and the county government’s initial efforts to improve the road, Henry Walsworth Kinney describes the same journey along the Hamakua coast. Kinney, writing tourism copy for the Hilo Board of Trade, claims that:

\begin{quote}
No visitor to the Island of Hawaii should neglect to see the road which leads north from Hilo to the Hamakua district. One of the most beautiful roads in the island, it presents, as it winds through scores of tropical gulches, a constantly changing panorama of unsurpassable beauty.
\end{quote}

\textsuperscript{65} Ibid.
\textsuperscript{66} Ibid.
\textsuperscript{68} Bird, 87.
\textsuperscript{69} Ibid.
To autoists the road is a delightful experience, and the ease of the grades and careful construction of the somewhat sharp turns will call forth his unstinted admiration of the road builders of the scenic isle.70

Between 1900 and 1905, the Territory undertook the laborious process of obtaining the necessary rights of way for the “Relocating and Reconstruction of the Main Road” and contracts were let for the construction of new concrete bridges and culverts to replace older, weak timber bridges in various locations along the North Hilo and Hamakua coast. In what one historian has termed a deliberate plan to wrest power for the Hawaiian and away from the American Territorial government, county governments were established by the Legislature of 1905. The counties were given the power to appropriate and expend funds through a county Board of Supervisors. However, the counties suffered chronic shortage of funds for road construction, even though money previously allotted to the state departments were being divided amongst the counties of Honolulu, Hawaii, Maui, and Kauai. The governor’s message to the 1911 Legislature suggested the issuance of territorial bonds for belt road funding, and $600,000 was subsequently made available to the Big Island from bonds that were floated. Utilizing these funds, the county began the systematic improvement of the island’s belt road and bridges.

The first contract from this fund was awarded in 1912 to A.A. Wilson, the Hilo contractor who had worked on Hilo Railroad’s Hakalau Extension. His contract was for the reconstruction of the belt road from Wainaku, just outside of Hilo, to Hakalau and included an unspecified number of bridges and culverts. His winning low bid was $98,698.35. The second contract was won by Territorial Senator John Brown the same year. He was to rebuild the belt road and bridges (with the exception of one long span in good condition) from Hakalau to Pohakupuka for $99,587. A third contract went to Lord and Young of Honolulu for the stretch between Kaawailii and Kealakekua, south of Kona, for $106,514.35. Not surprisingly, there were complaints voiced about the expenditure of the funds, the loudest emanating from the Board of Supervisors whose authority was being superseded. Many expected the $600,000 to build a whole new belt road, rather than the short, expensive pieces of road that resulted. Another bond issue in 1917 provided an additional $265,000 for Big Island roads, but the costs and difficulties of construction did not allow for the completion of the belt road until 1933.

At the beginning of the twentieth-century, the Hamakua Coast was the site of several major sugar plantation communities with tens of thousands residents. The Mamalahoa Highway was the main transportation link between the small plantation communities located along this coastline. The rugged terrain of the coast would not allow for the transportation of cane by road, thus elaborate flume systems were devised to get the sugar from the fields to the mills located along the coastline. Sugar was then processed at mills and off-loaded onto barges docked at the few landings for shipment to Honolulu or the Mainland. In many cases, the steep coastal bluffs made landing a ship impossible and necessitated the use of cable and pully systems to load the sugar into the holds of the ships. In 1911-12, the Hawaii Consolidated Railroad established a rail line to Paauilo and sugar was transported to Hilo for shipment from its harbor. The rail line brought many changes to the Hamakua coast, including the relocation of many of the mills away from the coast to access the rail service. Trucking sugar to Hilo along the narrow, winding government road (the Old Mamalahoa Highway) was not an economical alternative to the relatively straight run along the rail line.

**BRIDGES ALONG OLD MAMALAHOA HIGHWAY**

The suggested area for a proposed Mamalahoa Highway Historic Bridge District is comprised of forty-four bridges and thirteen culverts along approximately sixty miles of the Old Mamalahoa Highway on the island of Hawaii. The highway, also noted as the “Old Government Road” begins north of the Wailuku River in Hilo and passes through the districts of South Hilo, North Hilo and Hamakua. It terminates near the town of Kamuela at mile point 52 of the...

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Hawaii Belt Road. The highway was the principle belt road linking the small towns and sugar plantations along the Hamakua coast of the Island of Hawaii. The bridges in this proposed district include the oldest and rarest, as well as the most ornamental and scenic spans in the state.

The first road around the island was begun by the kingdom’s Department of the Interior in 1847, however it remained little more than a horsepath until the time of King Kalakaua. During Kalakaua’s reign (1874-1891) appropriations for public works improvements escalated, and many steel and timber bridges were constructed. Unfortunately none of these early bridges remain. Roadway and bridge construction was not significantly affected by the overthrow of the monarchy and the establishment of the Republic of Hawaii in 1893. However, after the annexation of Hawaii by United States in 1898, public works improvements, particularly bridge and road construction, became a priority on all islands. The fifty-seven bridges of the proposed Mamalahoa Highway Historic Bridge District were constructed between 1894 and 1933 and date from the Republic and early Territorial periods.

The earliest bridges are the masonry and solid-spandrel concrete arches constructed by the Republic - and later Territory - of Hawaii prior to the establishment of the county governments in 1905 (of which there are nine extant examples). Between 1911 and 1933, the County of Hawaii began to appropriate Territorial Loan Funds for the systematic upgrading of the island’s roads and bridges. The highest priority was placed on belt road improvement, and a series of reinforced concrete bridges were planned for stream crossings along the old Government Road. The bridges were designed by the County Engineer’s Office and built by local contractors. These county bridges were of two primary types: simple reinforced concrete girder or flat slab bridges for short spans (thirty-three examples); and more ornate and technologically sophisticated open- and solid-spandrel concrete arch bridges for longer, more visible spans (seven examples). The remaining bridges are inexpensive timber girder bridges built during the Depression years (eight examples).

Generally, one parapet end of the reinforced concrete county bridges is inscribed with a number indicating the island district in which it was built followed by the bridge number. The date of construction is inscribed on the other parapet end. The remaining bridges in South Hilo district are numbered from one to twenty-nine; those in North Hilo district are numbered from 103 to 126; and remaining bridges in the Hamakua district are numbered from 209 to 251. This marking system is unique to the bridges of the Old Mamalahoa Highway. The last county bridge was constructed on the Old Mamalahoa Highway in 1933. Between 1932 and 1958, the THD began to construct a new highway around the island. The modern highway, called the Hawaii Belt Road, became part of the Federal Aid Primary (FAP) highway system. The new road straightened out, bisected, and often bypassed the circuitous Old Mamalahoa Highway.

**NARRATIVE STATEMENT OF SIGNIFICANCE**

The bridges in the proposed Mamalahoa Highway Historic Bridge District are significant for their contributions to engineering and transportation in Hawaii. The development of the Old Mamalahoa Highway contributed to the economic development of the island by linking the small towns and sugar plantations along the Hamakua coast with the island’s principal port in Hilo. The bridges in the proposed Mamalahoa Highway Historic Bridge District are eligible under Criterion A as prominent products of the Republic of Hawaii and representative of Territorial and County public works efforts. The construction of the bridges was a deliberate investment in permanent public works improvements requiring the mobilization of skilled labor and significant public funds. Thus, these bridges were often constructed at important crossings along major transportation routes. The bridges served as important links in the circum-island transportation system, aiding in the commercial and residential development of Hilo and the Hamakua Coast. Reinforced concrete arch bridges were constructed to replace earlier timber and metal bridges. Many of these bridges were visually prominent, both in style and location, and made significant civic statements regarding the technical and aesthetic sophistication of the communities in which they were built. Concrete deck
bridges are eligible under Criterion A for their associations with the first use of formal engineering expertise in bridge making by the new county governments shortly after the annexation of Hawaii by the United States. These road bridges played a major role in the development of County of Hawaii’s belt road plan by connecting previously isolated communities with a paved highway.

The bridges are eligible under Criterion C since they represent a visual timeline of bridge construction technology in Hawaii. Nearly every historic bridge type remaining in the islands is represented along the Old Mamalahoa Highway. The masonry arch bridges are notable examples of the use of vernacular building materials and local craftsmen. Masonry and concrete arch bridges often evidence a high degree of detailing and workmanship and the few remaining examples are rare survivors of these once common bridge types. Furthermore, the reinforced concrete arch bridges constructed along the Mamalahoa Highway are among the earliest examples of reinforced concrete bridge construction in the state. Concrete deck bridges, including flat slab, girder and tee beam spans, are representative of the most common historic bridge type found in the islands. The majority of county built bridges, such as the Maili and Kaiwiki Bridges, were of this type as were the subsidiary spans on Mamalahoa-Honolii Bridge. Moreover, many of the bridges are examples of exceptional work by important local builders (the “work of a master”) such as Louis M. Whitehouse, Johnny Wilson, Peter and Charles Arioli, and Hisato Isemoto. Prominent designers include William H. Chun and En Leong Wung.

The fifty-seven bridges and culverts that make-up the proposed Mamalahoa Highway Historic Bridge District are evaluated as a group. Together these bridges form an area encompassing the entire sixty miles of the Mamalahoa Highway. Individually, the bridges in this proposed district range from technologically simple timber and masonry arch bridges to the more complex concrete deck girder and flat slab bridges. Together these bridges form a cohesive group built in a relatively short time period that document the evolution of style, methods and bridge building technology in Hawaii. This group of bridges played a critical role in the development of belt road transportation for the island of Hawaii.
V. HAWAII BELT ROAD, HAWAII ISLAND: PRE-CONTACT TO 1960s

HISTORICAL BACKGROUND

Many railroads were established in the Hawaiian Islands during the Kingdom, Republic and early territorial periods by private interests in the sugar industry. For the most part, these sugar trains were narrow gauge lines; however a unique standard gauge rail line was established on the Island of Hawaii to carry sugar cane along the rugged Hamakua coast to ports in Hilo. Fourteen large steel trestle railroad bridges were built in 1911-12; in 1950-53, five of these were modified by the Territorial Department of Transportation for use as highway bridges and another was constructed utilizing trusses from the span over the Wailuku River.

The plantations of South Hilo, North Hilo, and Hamakua districts were producing raw sugar within a few years after the Reciprocity Treaty of 1876. The treaty allowed Hawaiian sugar to be exported to the American mainland duty-free. The treaty was later expanded to include a clause that allowed the United States to build a Naval Station at Pearl Harbor on Oahu. The sugar industry developed rapidly in the islands; and by 1900, one-quarter of the sugar produced in the Territory was grown on the Hamakua coast. The land above the steep coastal bluffs, at the base of the dormant Mauna Kea volcano, was gently sloping and fertile. Most plantations were from two to three miles deep, their altitudes ranging from 250 feet closest to the sea to 2,000 feet at their upper boundaries; their ocean frontage varied from two to six miles. The rain which produced sugar had also produced the myriad gulches that had for so long kept the area isolated. The only road to Hilo’s harbor was the government wagon trail that was almost impassable in the rainy season and which suffered from constant bridge washouts. As an alternative to using the road, some plantations had railroads with either locomotive or animal power; others used flumes or cable railways to move cut cane from the high fields to the mills which were usually close to the sea. The mills employed a cumbersome method of derricks and pulleys at various landings high above the coast to load their produce on to ships for market.

Hilo was located at the southern end of the long string of sugar plantations on Hawaii’s east coast. Large tracks of prime agricultural land lay to the south of the town, awaiting development by entrepreneurs with vision and capital. In 1898, Benjamin Franklin Dillingham, a noted Hawaiian businessman, drew up plans for a large sugar mill at Olaa, eight miles south of Hilo in the previously uncultivated Puna district. Then he applied for a charter for the railroad that would be needed to transport the raw sugar to the wharf in Hilo. The Hilo Railroad Company was incorporated in 1899 by Dillingham; Lorin Thurston, the Minister to Washington during the Republic of Hawaii and a former Interior Minister under the monarchy; and Mark Robinson, Minister of Foreign Affairs for Queen Liliuokalani. The charter for the Hilo Railroad, granted by the Republic of Hawaii, was issued on March 28, 1899. Under its charter, the Hilo Railroad was authorized — for a period of fifty years — to build a railroad anywhere on the island of Hawaii, with free use of government lands for the right-of-way, yards, or station areas. Dillingham had just completed a three-foot gauge common carrier on Oahu and was aware that the popularity of narrow-gauge for trunk lines was on the wane; he announced that the Hilo Railroad would be built to standard gauge (4’-8 1/2” wide) — the first and only standard-gauge railroad in the islands.

The railroad barons determined that the wharf in Hilo was inadequate to attract the business of large shipping lines. Freighters anchored in deep water had to use lighters, and the whole operation was relatively unprotected from heavy seas during the storm season. A new wharf, sheltered from the sea by a breakwater, was proposed; but its construction was beyond the means of either the railroad or the Territory of Hawaii. The breakwater, designed by the U.S. Army Corps of Engineers, was financed by the U.S. Congress, leaving the railroad with the responsibility for building the wharf. One of the conditions imposed by the government for the improvement of
Hilo’s harbor was that the railroad company extend its railroad line north along the coast to service the sugar plantations of Hamakua.

The railroad construction project was a daring engineering feat that crossed the numerous gorges and streams with large steel bridges at the valley mouths and required massive earth cuts for the completion of the comparatively straight road bed. This was in direct contrast to the more conservative government policy of winding roads and small concrete or timber bridges in the backs of valleys or down sharp grades to sea level. The high cut in the north wall of Hakalau gulch remains as an example of the degree of earth moving accomplished by the railroad engineers. Work on the first section — 12.7 miles from Hilo to the Hakalau Mill — began in 1908 and was completed in 1911. Construction of the second phase — from Hakalau to Paaulio — continued through 1912, with costs of $106,000 per mile, for a total of $3,500,000. The company succeeded in erecting fourteen steel bridges, five wood and steel combination bridges, and twenty-four wooden trestles. These bridges, along with two tunnels and expensive grading, gave the Hilo Railroad “one of the highest per-mile construction costs of any railroad under the Stars and Stripes.”

The specifications and design for the bridges were drawn up by John Mason Young, the founder of Pacific Engineering Company of Honolulu and a pioneer faculty member of the College of Agriculture and Mechanic Arts (later the University of Hawaii). Young had been involved in steel bridge design and construction on mainland railroads before coming to Hawaii. The bridges’ components were ordered from the New York firm of Hamilton and Chambers (who also fabricated the steel for the Hanalei River Bridge on Kauai the same year) and were erected by W.W. Beers, described by the Hilo Tribune as a New York engineer. All of the steel trestle bridges erected by the railroad were of the same type, deep steel girders with 66 to 72 foot spans set on wide steel trestles and masonry (lava-rock) abutments. The bridges were assembled at the Waiakea railroad yards and shipped out to their sites on railroad cars.

The Hakalau trestle, built in 1911 during the railroad’s second phase of construction, was one of the most impressive bridges built by the Hilo Railroad. At 775 feet long and sitting on seven steel towers, the Hakalau Bridge was the second longest bridge on the line, outdistanced only by the Maulua Bridge at more than 1000 feet. After the Maulua Bridge was taken down, Hakalau was converted for use as a highway bridge and was, for several years, the longest highway bridge in the territory until the Kalihiwai Bridge on Kauai and the Pearl City Viaduct on Oahu were built. Hakalau was also among the tallest with a height of 171 feet, only 30 feet shy of the tallest bridge over Nanue Stream. As late as 1981, Nanue was the highest bridge in the state at 207 feet. A higher bridge had been built at Maliko Gulch on Maui, but it was dynamited in 1967.

In addition to the steel trestles built by the Hilo Railroad, two multi-span steel truss bridges were constructed over the Wailuku and Wailoa Rivers. These bridges suffered from their positions close to sea level and were the most problematic for the railroad to maintain. The Wailoa drawbridge was destroyed in 1923 by a tidal wave and was remounted on concrete piers. The Wailuku railroad bridge suffered several mishaps. While it was being erected in 1909, a Porter tank engine slipped over its edge into the river. Fifteen years later, “it collapsed in a mysterious manner,” its piers folding like dominos. The collapse was attributed to the 1923 tidal wave and earthquake, and was precipitated by the passage of a loaded passenger train. In 1924, the Wailuku Bridge was replaced by a metal truss bridge of three spans, mounted on concrete piers. These bridges only lasted in place until the 1946 tsunami.

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72 Thomas Thrum, Hawaiian Almanac and Annual (Honolulu: Hawaiian Gazette Company, 1924), 94.
Burdened with debt and unable to meet its obligations, the Hilo Railroad Company was forced into receivership in 1916 and plans for the expansion of the line were abandoned. The railroad was sold for $1,000,000 to the bondholders, and reorganized as the Hawaii Consolidated Railway. In 1920, the new owners bought three additional passenger coaches as part of a program aimed at catering to the tourist business. In cooperation with the steamship companies, sightseeing specials, operating under the name of *Scenic Express*, were run on the Hamakua Division when passenger ships were in port. Author Gerald Best described his experience traveling along the coast: “We had seen waterfalls cascading down the slopes of Mauna Kea, passed through magnificent groves of tropical trees and entrancing fields of flowers, and looked upon a completely unforgettable vista of sea and mountains. No wonder the tourists who rode the *Scenic Express* years ago recalled it as the highlight of their visit to Hawaii.”

In the 1930s the Depression affected the tourist trade and passenger business dropped off to a low of 16,681 in 1936. Passenger cars were retired, and some cars were converted to haul *bagasse* (sugar cane after the juice has been pressed out) to the cane manufacturing plant in Hilo. During World War II, passenger business picked up due to gas rationing, and several old coaches were used to transport servicemen from Hilo to Paauilo, en route to the U.S. Marine Corp training camp at Waimea. By the end of 1945, the railroad was making money and would soon be out of debt for the first time in its existence.

On April 1, 1946, a tsunami hit Hilo at 7:01 AM. The Hawaii Consolidated Railroad suffered irreparable damage. Freight cars were floated inland, all of the track along the waterfront was washed out, the Hilo station and the adjacent buildings were in shambles, and the first span of the Wailuku River bridge, a steel truss, was washed hundreds of feet up the river. In spite of the breakwater, freight cars on the docks were washed into the bay, some floating out to sea and others thrown up on shore. Twelve miles north of Hilo, the railroad bridge at the mouth of the Kolekole Stream lost its center span. Facing an estimated repair cost of $500,000, the railroad asked shippers to determine whether they would use the line if it were rebuilt or were intending to ship their raw sugar by truck. Only Theo H. Davies Ltd. voted to retain the railroad; the rest voted to use the existing highways, despite their poor condition. Hawaii Consolidated then offered its entire right-of-way, including all bridges and tunnels, to the THD and to the County of Hawaii supervisors. Both agencies declined the railroad’s offer.

The entire railroad was sold as scrap to Gilmore Steel & Supply Company of San Francisco for $81,000. About the time the scrappers had finished pulling up the rails and begun dismantling the steel bridges, the THD decided that the Hawaii Belt Road, along the Hamakua Coast, should be improved by relocating it along the railroad right-of-way and utilizing the railroad trestles as highway bridge supports. In great haste, it made a deal with Gilmore Steel & Supply to buy those bridges still in place, as well as the parts of bridges already trucked to Hilo, for $303,723.53 - nearly four times the amount the scrappers had paid to Hawaii Consolidated for the entire railroad.

In 1950, the THD, under the direction of William R. Bartels, and the Independent Iron Works of Oakland, California undertook the “Seismic Wave Damage Rehabilitation Project.” Plans were developed to adapt the existing steel railroad trestles into highway bridges. Utilizing remnants of railroad trestles and trusses, the road beds were widened and strengthened. The Hakalau Bridge, for example, utilized steel girders scavenged from the Kealakaha, Laupahoehoe, and Kaula trestles; the steel bents were taken from the Maulua Bridge. A macadamized concrete deck was laid and concrete rails installed along both sides of the new highway bridges. The two remaining truss spans of the Wailuku River Railroad Bridge were incorporated into the reconstruction of the Kolekole Highway Bridge. Two concrete piers from the truss bridge remain in use under the present Wailuku Bridge which carries the Hawaii Belt Road (designated FAP 19) over the river.

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The steel railroad bridges built by the Hilo Railroad Company lasted the life of the railroad and beyond. However, even after their reconstruction, they have proved to be expensive to maintain. A Department of Transportation maintenance team, the “High Bridge Crew”, is dedicated solely to the upkeep of the five remaining steel trestle bridges, while another crew is able to maintain all the other state bridges on the island.

**THE HILO-HAMAKUA HERITAGE COASTLINE**

The windward part of the Big Island (once known as The Sugar Coast) is a continuous series of plantations linked from Hilo to Honokaa. A railroad hauled sugar to the Hilo piers and provided a lifeline for transporting people and supplies. High trestles spanned the gulches of this part of the island.

This region is Hawaii’s wet district, starting at Upolu Point, the northern tip of the island, and running through Hamakua and into the Hilo District, which supported many large sugar plantations. From Niulii in North Kohala, the coast is a series of canyons with rivers pouring out of the Kohala Mountains or off of Mauna Kea. Travel was problematic closer to the coast.

After the tsunami of 1946, construction of the new Hawaii Belt Road (FAP 19) was accelerated. The new road was an engineering feat, containing fifty-six bridges in forty-two miles.

The THD’s first post-war priority on the Big Island was the Hamakua Coast Highway. There were several reasons for this immediate attention. The upgrade of the existing roads had been interrupted by the war, and what existed was piecemeal. In addition, the Hawaii Consolidated Railway service to sugar plantations was terminated and plantations were forced to truck their sugar to Hilo on the narrow winding Belt Road. This method was dangerous for the large trucks as there were many hairpin turns and periodic bridge washouts.

Some of the components of the defunct railroad bridges were reused for the upgraded two-lane highway between Hilo and Honokaa. The complete reconstruction of these forty miles of highway was quite expensive, since it was “Hawaii’s most brided highway” with more than one bridge per mile. The original cost estimate for the road was twelve million dollars and included a “Highline” portion of the highway from Pepeekeo to Ookala. The existing route consisted of 340 curves with narrow bridges varying from 12’ to 18’ wide. The proposed highline portion would have realigned this twenty-four miles of dangerous highway at a higher elevation where the gulches were less wide. The Hamakua “Highline” proposal was subsequently not adopted, and the cost of this section of highway grew to 17.5 million dollars by the mid-fifties.

Roughly two-thirds of the Hamakua road was finished (a total of thirty-five bridges) during the tenure of Highway Commissioner Robert M. Belt, from 1952-1958.  

**POST-WAR HAWAII BELT ROAD BRIDGES**

There are a number of significant bridges constructed after World War II along the Post-War Hawaii Belt Road; thirteen of these bridges represent the best examples of post-war bridges in the state of Hawaii. Along the same stretch of road, there are an additional 6 trestle bridges built during the same post-war time period, which are listed on the HSRHP. (See Hawaii Belt Road Map, Chapter 6.) The Post-War Hawaii Belt Road is not considered as a district, but bridges are significant as a group of post-war bridges on the Belt Road.

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Additionally, many of these bridges are the work of a person of significance - William R. Bartels, Chief Engineer for the THD, who was responsible for all major territorial bridge projects from 1932-1956. Bartels was a German born engineer who worked briefly for a sugar plantation on Maui before being hired by the THD in 1932. He designed most of the territorial bridges from then until 1957.

Bartels was responsible for the largest and most sophisticated bridge construction projects in Hawaii during this time and there was a marked shift to large deck girder and rigid frame bridges. Bartels was considered a “cracker-jack” engineer who enjoyed the challenge of a difficult assignment, and his work characteristically utilized the latest technology and involved a high degree of engineering complexity. Nonetheless, his bridges show refined aesthetic sensibility which makes them distinctive from work of other engineers. He ended his tenure as Chief of the Bridge Division at age 70. This was well past the standard age of retirement, but he was kept on by special permission and out of necessity as his abilities were so great. Bridges designed by Bartels have often been hailed for their accomplishment of engineering as well as aesthetics.
VI. THE PALI HIGHWAY, OAHU: PRE-CONTACT TO 1960s

HISTORICAL BACKGROUND

Plans to build a tunnel to link Honolulu and the windward side of Oahu were discussed prior to World War II, but the war forced a postponement. Later, the rapid growth of the city’s population, the development of residential areas on the windward side, as well as the needs of the armed services during World War II convinced public officials that building a tunnel through the Koolau Range was inescapable. With each passing year, it became more and more obvious that the existing, narrow Nuuanu Pali road no longer met the transportation needs of the rapidly growing communities on the windward side, as between 1940 and 1950 Kailua’s population increased four hundred percent, going from 1,400 to more than 7,000.

The only question which remained to be answered was where to place the tunnel. This proved to be not a simple question to answer, as the City and County of Honolulu and the Territory of Hawaii had different thoughts on this matter, the former advocating a tunnel through the Koolau Mountains via Kalihi valley, while the latter preferred following a route through Nuuanu valley. While the City & County was moving ahead with plans for Kalihi valley, Territorial SPW Robert Belt in December 1947, unveiled two alternative plans for converting the existing Pali Road into a four lane highway which in the eyes of Nuuanu residents was, “a ‘four lane roadway’ running through their neighborhood.”75 In addition, to Nuuanu residents, the City & County led by Mayor John Wilson, also expressed opposition to the highway plans, as they saw them as competing for limited federal funds, which the Mayor hoped to obtain for the construction of the county proposed highway through Kalihi. In the ensuing years the pros and cons of each alternative were repeatedly raised, traffic counts were made, population growth was studied, military opinion was solicited, and financial programs were analyzed in an effort to settle upon one of the routes and throughout the process both governments steadfastly advocated for their proposal. Eventually both highways were built; however, it took over a decade of bickering, courtroom fighting, delays, and squabbling to attain the result.

The issue of choosing between the Kalihi and Nuuanu tunnel routes appeared to be finally settled when the Federal Bureau of Public Roads (BPR), on December 1, 1949, approved federal funding for the Territory of Hawaii’s proposed Nuuanu valley tunnel project. The decision came at the end of a two week, on-site study by the Bureau’s Western Region Chief L. I. Hughes, Division 7 Engineer Charles C. Morris, and District Engineer Frank F. Carlson. In their report the federal officers based their finding on the fact that the current Nuuanu Pali road was, “now close to the possible capacity of the highway.”76 The report went on to state that no federal aid would be made available until the Territory of Hawaii and City and County of Honolulu came to a resolution on the highway route between Country Club Road and Reservoir No. 4, as the City & County Planning Commission had refused to amend the City’s Master Plan to include the Territory of Hawaii’s proposal for a new, realigned Pali Highway. Governor Stainback resolved this issue by executive order three days after the release of the federal report, when on December 3, 1949 he set aside the City & County’s master plan with regards to the Pali Highway.

Federal officials also noted that when granting their approval for the proposed highway running up the Ewa side of Nuuanu valley, they did so with the understanding the section of the existing Pali Road between the Carter residence and the Halfway House on the windward side of the island would remain undisturbed as a scenic

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75 “City Will Protest Nuuanu Road and Ask Fund Delay,” Honolulu Star-Bulletin (Honolulu, HI), December 17, 1947.
alternate or detour for tourist or sight-seeing traffic. The report also indicated the Bureau of Public Roads would look favorably upon a request to provide federal aid to a spur road in Kalihi Valley which would run from School Street to the Forest Reserve. The City and County would need to fund any service roads connecting to the federally assisted spur road. Also the report noted that while assisting in the development of the Kalihi valley road, that proposed project “should not impair other necessary federal aid construction, that is, the Pali Highway.”

In conclusion the report noted, “when future traffic needs warrant, this Kalihi route shown by the Planning commission survey will be considered for inclusion in the federal aid system.”

As a prelude to the construction of the new Pali Highway, the Territorial DPW opened bids on December 21, 1949 for a new four lane highway which would run from the Kaneohe Ranch office building at the foot of the Pali to the Kailua-Waimanalo Junction. J. M. Tanaka secured the contract for the new, 1.86 mile highway, with a bid of $963,319. Considered to be “one of the territory’s most modern highways” the new four lane divided highway replaced an existing narrow, two lane road, a segment of which is now known as Auloa Road. The new highway followed a completely new alignment, and although only three tenths of a mile shorter than the existing road, eliminated twenty two curves, supplplanting them with two curves, each with a broad radius.

To facilitate this more direct, straight line route, a hillside was cut resulting in the excavation of over 600,000 cubic yards of dirt, and two bridges were constructed, one over Maunawili Stream and the other over Kahanaiki Stream. In constructing the Kahanaiki Stream Bridge a new technology, involving the driving of sand drains was employed. In order to overcome the fifteen to forty feet of mud in the stream bed, a sand-filled, fifty-foot-long steel pipe, twenty inches in diameter, with a mushroom like cap at the bottom, was driven into the stream bed. As the pipe was removed the sand inside filled the hole. Over two hundred of these sand drains were placed in the six hundred foot stretch of road crossing the Kahanaiki Swamp. The drains allowed settlement, which usually required ten years, to occur within 120 days. In addition, Maunawili swamp was cleared of three to four feet of mud and filled with sand with dirt placed on top and left to settle while other parts of the road were constructed. A pile driver, using an S-8 hammer, drove the Maunawili Stream Bridge piles at the rate of 26,000 foot pounds per blow, with 55 blows a minute. Apparently the sand drains did not perform as well as expected. On November 1, 1951 Harvey A. Jerome, in a letter to the editor of the Star-Bulletin, complained that one of the two new Kailua bridges were under repair following a day and night of heavy rain.

In addition to the Kaneohe Ranch to Waimanalo junction project, the THD let a $371,221 contract to E. E. Black for a four lane highway between the Kailua-Waimanalo junction and the Kawaihui Bridge in Kailua, expediting Kailua residents’ journeys to the base of the Pali. With the opening of the two projects on September 3, 1951, Governor Oren E. Long declared the roadway, “the first step in the completion of the road over the pali.” He predicted it would encourage many more people to establish homes in Kailua.

The opening of the new roadway increased windward residents’ demands for the construction of the new Pali Highway, as a bottleneck formed at the Kaneohe Ranch office where motorists had to merge from two lanes to one. During the morning rush hour between 7 and 8 a.m., 914 automobiles crossed the mountain, including 149 from Kaneohe which merged with the Kailua traffic, causing further delays. Traffic counts revealed that during the course of a 24 hour day 4,090 Honolulu-bound vehicles made the ascent up and over the Pali. In an effort to reduce the bottleneck a policeman was placed at the bottom of the Pali Highway to direct the traffic coming from

77 Ibid.
78 Ibid.
79 “New Highway to Kailua Will Have Four Lanes, Cost Million Dollars,” Honolulu Advertiser (Honolulu, HI), August 6, 1950.
Kaneohe, and an older section of the Pali Highway, which entered the existing road at the Halfway House, was closed to Kaneohe motorists during rush hour. By September 1953 the steep, twisty, windy road was carrying over 11,000 vehicles a day, as compared to about 7,700 in 1951, and 2,899 in 1938. By 1957 this number had climbed to 16,000. According to federal standards, the existing road was considered adequate and safe to handle only 4,000 vehicles a day.

Shortly after the opening of the new Kailua Highway, the Territorial DPW took the first step in its incremental construction of the Pali Highway. Using federal aid moneys matched by the Territory of Hawaii’s vehicle fuel tax, the THD awarded contracts as money allowed, thereby not putting the government in debt. The first contract, for $514,373, was awarded to Moses Akiona, who commenced work in February 1952 on the stretch of road between the Kaneohe Ranch office and the old roadway’s hairpin turn. This new 1.4 mile section of road would have only three curves including a sweeping horseshoe, as opposed to the existing twenty-two. No bridges were in this section, but there was much cutting and filling, with 560,000 cubic yards of excavation anticipated. Akiona’s company dynamited and cut through solid rock, graded down hillsides and filled in deep canyons to develop a smooth roadway. The cuts through the mountain were deep ones, with one going 150 feet deep into the hillside. To avoid slides, three of the slopes were carved out in stepped terraces, a process known as benching. Delayed by inclement weather, as well as proposed re-designs, this segment of the highway was not completed until December 1953.

The second increment of the highway to be built was a one mile segment of the four lane highway from Reservoir No. 4 through the Forest Reserve up to where a proposed tunnel would go through the mountain under the Pali Lookout. In March 1954, J. M. Tanaka, under a $600,000 contract, commenced construction on this fairly straightforward segment and completed construction in April 1955.

Several months after J.M. Tanaka completed Nuuanu Valley’s mauka-most segment of the Pali Highway, the THD, on June 22, 1955, awarded the company a second contract, for $1,979,059.90 to construct two tunnels, measuring twenty two feet high and twenty nine feet wide, with one running 1,000 feet in length under the Pali Lookout and the other being a 500 foot bore through a ridge further toward Kailua. In addition the contract included a bridge to connect the two tunnels. These two tunnels were the first of four to be built and were intended to carry town bound traffic up the Pali and into Nuuanu, thereby alleviating as quickly as possible the steep grade for uphill travelers. The contract was the largest, up to that time, ever awarded by the THD.

Planning for the tunnels had commenced several years prior, as in March 1953 the Territorial DPW awarded a $21,900 contract to Samson & Smock to undertake substrata testing between the hairpin turn and Reservoir No. 4 to determine the nature of the soil and rock through which the new highway had to go. Using a water-cooled, diamond bit the firm drilled thirty three holes to gather sufficient materials for analysis, with most of the cores being on the windward portion of the route.

Approximately twenty months after a cave-in had claimed the lives of five men working on excavating the future Likelike Highway’s Wilson Tunnel, J.M. Tanaka started work on the Pali Tunnel project on August 1, 1955. In light of the earlier tragedy, contractors bidding on the project had to complete a twelve-page questionnaire to indicate their competency to do the job safely and well.

First an access road to the Kailua side portal of the smaller tunnel had to be cleared and graded. This portal was chosen as the place to begin excavations as the only practical dumping area for excavated materials was on this side. Work on the tunnels was further complicated by a ban on having primed explosives transported to the site via the Pali Road. As a result the dynamite was hauled up the face of the mountain via an overhead conveyor from
the valley below. Blasting started on the 500-foot Pali tunnel on October 26, 1955. The tunnels were designed by Anatol Eremin, a civil engineer who worked for the California State Department of Public Works. He authored *Highway and Railroad Bridges with Simple Continuous Spans* (1956), and following the completion of the Pali tunnels, *Tunnels, Underground Structures and Air raid Shelters* (1958). In addition, a number of engineers monitored the tunnel and its progress. Bung Y. Hee was the contractor’s engineer, and Charles Peterson was the contractor’s tunnel superintendent. Erwin F. Morrison was the Territory’s chief tunnel engineer, and Charles Boerner served as a tunnel advisor. Boerner administered the structural engineering branch of the Navy Public Works office’s Engineering Division and previously was the engineer in charge of the construction of the Navy’s underground fuel storage facility in Red Hill.

Three crews worked around the clock, advancing approximately forty feet a day. Following a routine of detonating seventy five pound dynamite packs and then clearing the debris with shovels the workers breached the far side of this shorter tunnel on November 26, 1955. To build the tunnels, the “Top Heading” method was used. First two “drifts,” smaller tunnels dug within the intended tunnel, were bored. These allowed the side walls of the tunnel to be built before the entire tunnel was dug out. Once both the drifts breached the far side of the tunnel, concrete footings were poured, which formed the bases for the tunnels barrel vaulted, steel arched ceiling. Working from an elevated platform mounted on a truck, the workers next cut out the top portion of the tunnel and installed supports before finally removing the central core of the tunnel. In the 1,000 foot long tunnel, workers were confronted with solid rock for the first 550 feet, before hitting softer dirt as they neared the leeward portal.

On May 22, 1956 workers digging from both sides of the longer tunnel, shook hands after shoveling through the last few feet of dirt and rock. Work on the two tunnels, except for the asphalt paving of their roadways was completed by December 13, 1956. Work then commenced on the second set of tunnels, with break through occurring on June 18, 1958. The second set of tunnels was opened to traffic on December 30, 1960. With their opening, the segment of the old road from the Pali Lookout down to the Hairpin Turn was closed off and permanently abandoned, as two ridges on which it sat were cut away.

While J. M. Tanaka was busy at work on the tunnels, a $323,688 contract was awarded to Oahu Construction Company on March 1955 to build the segment of the Pali Highway between Country Club Road to Carter’s Corner, a distance of approximately a half mile. This work essentially widened the present road from two to four lanes divided by a median strip. This rather straight-forward segment was completed on May 14, 1956. Another contract for the highway segment from Country Club Road down to Laimi was let to J. M. Tanaka and was completed by July 25, 1957, and the segment between Laimi and Coelho Lane went out to bid at that time.

At the end of 1955, J. M. Tanaka, who already held the $1,979,059 contract for the tunnel section, was the low bidder, at $677,415.80, for the half mile, two lane segment of the new highway from the hairpin turn to the entry of the smaller tunnel. This segment included the excavating of over 30,000 cubic yards of material with several small ridges blasted and bulldozed. In addition, a series of five bridges, supported by poured in place, reinforced concrete piers, some as high as 77 feet, were constructed to bring motorists up to the tunnel entrances. To pour the concrete, mixers had to stop on the existing Pali Road, and from this vantage point pump the concrete down to fill the waiting forms. Looking up from the Pali Golf Course, Gordon Morse declared, “the series of bridges curving up the side of the sheer Pali look like something out of Walt Disney’s Fairyland.” Making the scene more impressive was his knowing that every three feet of roadway carried by the bridges weighed two tons.

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81 “Need for Pali Tunnel Cited Here Century Ago,” *Honolulu Advertiser* (Honolulu, HI), December 2, 1956.
With the completion of the bridges, the windward side of the Pali Highway opened on May 11, 1957 and was declared an “engineering masterpiece” by the newspaper because the new route involved only two sweeping curves instead of the series of former turns. The newspapers noted that motorists would be surprised to not have to shift into second to climb the grade, and they would feel like they were “traveling a flat, straight city boulevard but with scenery and without congestion.”

Honolulu bound traffic cruised up the mountain, through the tunnels and into Nuuanu valley before bottle necking at Reservoir No. 4. Windward bound traffic drove up Nuuanu valley over segments of two and four lane road to the base of the Pali Lookout where drivers ascended up to the lookout and then down the old road until it intersected the new near the horseshoe turn.

With the first pair of tunnels open and the second under construction, the THD turned its attention to the segment of the new highway which ran from Country Club Road to Reservoir No. 4. Work had been long delayed on this segment as the Territory became embroiled in a contentious legal battle with Lester and Elizabeth Marks over the condemnation of 2.2 acres of their 17 acre estate. The case began in 1949 when the Territory filed a suit in Circuit Court to condemn the property with a condemnation price of $12,000. The case made its way to the Territorial Supreme Court, was remanded to the lower courts and again made its way to the Territorial Supreme Court. While the case still simmered in court, with both sides intimating they intended to go beyond the Territorial Supreme Court, windward drivers agitated for the construction of the new segment as it bypassed a section of their daily commute now known as Nuuanu Pali Drive, which included Morgan’s Corner, a dangerous bend in the road. Between December 1949 and June 1955, 187 accidents occurred on this two mile stretch of road, with 66 injuries and two deaths that both occurred at Morgan’s Corner.

Consequently, the Territorial Attorney General authorized the Territorial DPW to negotiate with Marks for the entire seventeen acre parcel. Finally in December 1956 an agreement was reached where Marks retained ten acres on the west side of the proposed highway, while the Territory purchased the other seven acres, including the Marks’ residence for $624,750. The settlement opened the way for the awarding of a $1,370,014 contract to James W. Glover for the important segment between Country Club Road and Reservoir No. 4. This two-mile stretch of highway included 4,000 feet of two-level road, as Kailua-bound motorists traveled about thirty feet below the parallel Honolulu-bound lanes. A relatively new design concept for Hawaii, it served two purposes: economy by reducing the amount of excavating on the upslope side of the valley, which alleviated the need for benching to reduce the chance of landslides. The Highway Department also pointed out the advantage of this design to reduce driver fatigue by not having to face on-coming headlights. This two-level highway concept previously had been used on Kamehameha Highway between Kipapa and Wheeler Field, which was completed in 1950.

To handle the wet environment of this part of the valley, this new section of the Pali Highway included eight foot wide drainage gutters of each side of the highway, and required the construction of thirteen box culverts under the highway to permit the water rushing off the Nuuanu cliffs to go its normal way into run-off gullies. In addition, twenty catch basins were built. The largest box culvert was twelve feet by ten feet and drained 240 acres Ewa of the highway. This segment of the highway was completed on March 31, 1959. Two months later, on May 11, 1959, the Kailua-bound tunnels were opened to travelers.

82 “New Road Opens A New World,” Honolulu Advertiser (Honolulu, HI), May 11, 1957.
81 “Straightening the Hair Pin,” Honolulu Advertiser (Honolulu, HI), August 2, 1953.
The final stretch of the Pali Highway to be completed was the segment which connected it to the downtown area between Coelho Lane and the intersection of Bishop Street and Beretania Street. Planning for this segment had begun as early as 1953, and at that time Nuuanu Avenue was slated to become a one way street into Honolulu. Bishop would be extended to connect with Fort Street at Kukui Street, and Fort would become one way in a mauka direction up to Wyli. This preliminary proposal for the Pali Highway’s downtown connection underwent revisions, and when presented to the City and County Planning Commission in 1955 for inclusion in the City & County’s master plan, it was adopted. In the final proposal Nuuanu Avenue was no longer to be widened as a connector, and instead Fort Street was expanded into a four lane roadway. Bishop Street became one way moving in a makai direction, while Alakea Street was made one way heading mauka. Fort Street merged with a new highway segment above the Honpa Hongwanji.

The Honpa Hongwanji, whose property was bisected by the proposed new segment, requested three of its buildings be relocated and a pedestrian underpass be constructed under the new highway to connect the temple with its school premises. The new segment ran close to the lower slope of Pacific Heights and crossed Nuuanu Stream via a bridge just above Kapena Falls. The project also included over- or under-passes at Wyliie, Pauoa, and School streets, as well as a cloverleaf to allow Nuuanu Avenue traffic to access the new highway just above Wyliie Street. Moses Akiona received the contract for the segment of the highway between Kuakini Street and Wyliie Street and commenced construction.

In addition, a contract was awarded to Hawaiian Dredging & Construction on April 2, 1959 for $3,034,000. This included the section of the Pali from Kuakini to Bishop and Beretania streets and also included the Lunalilo Freeway between Nuuanu Stream and Pele Street. At the time of its issuance this was the largest contract ever let by the THD. This segment included the Islands’ first three level grade separation, designed by Law & Wilson, to link the Pali with downtown and the Lunalilo Freeway. The Lunalilo Freeway was to carry the bottom level of traffic, while the top level was an off ramp from the Honolulu-bound lanes of the Pali Highway to the Kaimuki-bound lanes of the Lunalilo Freeway, with the Pali Highway in the middle. It was estimated the new alignment into downtown would save the Territory over two million dollars in rights-of-way expenses when compared with the initial proposal to expand Nuuanu Avenue to Coelho Way.

With the completion of these final links, the Pali Highway officially opened on August 1, 1961. Running from the Kaneohe Ranch Office to Bishop and Beretania, the 7.9 mile highway allowed speeds up to 45 miles per hour, more than double the speed on the old road. The new, twenty-two-million-dollar thoroughfare reduced the travel time between Kailua and Honolulu to approximately 15 minutes, as compared to the 45-minute trip on the former road during the day and up to 90-minute commute during morning or evening rush hours. When completed, the new highway was designed to carry 25,000 vehicles a day.

Following the opening of the new highway, several safety features made their first appearance in Hawaii on the Pali Highway. In December 1962, a drapery of chain link fencing, designed by State Highways Division engineer Herbert Tateishi, was hung above the Pali Highway on the cliff immediately below Wyliie Street to prevent falling boulders and debris from bouncing onto the highway. The fencing hung from a 110-foot-long, six-inch diameter pipe secured to the top of the cliff. Although used before on the mainland, this was the first time it was employed in Hawaii. Another Hawaii first transpired in December 1966, when Jersey Barriers were installed by the Royal Contracting Company along the horseshoe turn on the Pali Highway’s windward side. Poured in place along the medial strip, the two and half foot high barriers had curved sides to deflect wayward cars back into traffic.
IMPACTS OF THE HIGHWAY

While the new highway had a direct and positive impact on the commute time between the windward side and downtown Honolulu, it also had many indirect impacts. A Star-Bulletin article from as early as 1954, foresaw the ramifications the proposed Pali Highway would have on the development of the windward side of Oahu, especially Kailua and Kaneohe. The article observed, “Modern roads spur suburban living because they convert commuting from drudgery into a relaxing interlude,” and went on to foresee the highway bringing to Honolulu’s doorsteps suburbs a mountain range away. With the opening of the first two tunnels, the newspaper referred to the two tunnels as the “Gateway to Tomorrow”. It noted that, as “impressive and welcome as this project is, it’s still only a chapter in the impressive story of Windward Oahu’s development,” and went on to predict, “IT’S ONLY THE BEGINNING!”

Indeed, it was only the beginning. Knowing the two new highways were forthcoming, Kaneohe Ranch, which already had Aikahi Hillside under construction in 1957, began planning a 450 house subdivision known as Kalaeo Hillside, 500 houses in Kapunahala, and 2,000 dwellings in the 750 acre Luluku subdivision. Another 700 houses were slated to go up near the intersection of the new Waimanalo Road and recently completed Kailua Road, the first major development between Kailua town and the base of the Pali. In addition, Bishop Estate commenced planning a large subdivision on its lands in the Haiku area and the Hawaiian Home Lands Commission started to open up lands in Waimanalo for residential use. It was anticipated that by 1967 over 10,000 new homesites would be erected on Kaneohe Ranch lands, which was very conceivable considering that during the four years between 1953 and 1957, the company sold a house a day.

To accommodate the anticipated population growth, the Department of Public Instruction commenced construction of a new Kailua High School in 1957, and planned to convert the existing high school into an intermediate school. The Kaneohe Elementary School opened in 1956. The department also programmed for three new elementary schools in Kailua, and King Intermediate School and Haiku Elementary School in Kaneohe. Also, district parks were constructed in both Kailua and Kaneohe, as well as a number of small neighborhood playgrounds such as at Kaelepulu and Kalaeo. The Board of Public Parks and Recreation also opened the 225 acre Pali Golf Course in 1956, which was designed by Willard Wilkinson. Harold Castle donated half the land for the course, as he desired to preserve the verdant character of the windward side from the Pali Lookout and upon descending from the new highway.

Also, newer, better roadways were constructed to service the two trans-Koolau highways. The Kamehameha Highway between the Pali intersection and Kaneohe Bay Drive, a distance of 2.4 miles, was widened to four lanes, with work starting in 1957. Also a new three-mile road between Waimanalo and the Pali Highway intersection, now defined by Castle Hospital, was constructed, while the City & County handled construction of the Kahekili Highway.

Other developments that emerged with the Pali and Likelike nearing completion included the seventy-acre Hawaiian Memorial Park and the forty-bed Castle Memorial Hospital, operated by the Seventh Day Adventist Church. Also, the Windward City Shopping Center at the intersection of the Likelike and Kamehameha Highways joined the already-operating Kailua Shopping Center, which was completed in mid-1954. The latter underwent a

85 “$100 Million in Housing is Foreseen,” Honolulu Star-Bulletin (Honolulu, HI), May 10, 1957.
86 Ibid.
dramatic expansion in 1957, including a Times Supermarket. Foodland had opened in Kailua in its own building in 1953.

Thus, the highway not only made the commute from the windward side of Oahu to Honolulu more appealing to the existing motorists, but it also convinced others that the distance from town was not a detriment to living in the country.
VII. THE FEDERAL AID HIGHWAY SYSTEM AND INTERSTATE HIGHWAY SYSTEM ON OAHU: 1911 TO 1953

HISTORICAL BACKGROUND

Federal Aid in the construction of a system of State and National highways was made available to all the States in the continental United States in 1916. The Federal Aid Highway Act was developed in the 1930s due to building pressure for the construction of transcontinental superhighways. A feasibility study of a six route toll network in 1938 showed insufficient transcontinental traffic to support a network of toll superhighways. A Master Plan for Free Highway Development also recommended in this study a 43,000-kilometer non-toll interregional highway network. On April 14, 1941, a National Interregional Highway Committee was appointed by the president FDR to investigate the need for a limited system of national highways. In 1943, a report, Interregional Highways, recommended an interregional highway system of 63,000 km, designed to accommodate traffic 20 years from the date of construction.

Disagreements in the highway community resulted in an inability to agree on the major changes needed in the post-war era to address accumulated highway needs during the beginning of the Federal Aid Highway Act of 1944. The Public Roads Administration (PRA), as the BPR was now called, began to work with state and local officials and the American Association of State Highway Officials (AASHO) to develop interstate plans and design standards for the interstate system, which were approved in 1945 that address conditions such as traffic, populations density, topography, and other factors.

Even though the PRA announced the designation of the first 60,640 km of interstate highway in 1947, construction of the interstate system moved slowly. Many States did not wish to divert Federal Aid funds from local needs. Others complained that the standards were too high. By July 1950, the United States was again at war in Korea and the focus of the highway program shifted from the civilian to military needs. In 1953, the States had completed 10,327 km of system improvements at a cost of $955 million. Only 24 percent of interstate roadway was adequate for present traffic, which was still far from meeting the traffic expectations for 20 years in the future.

At the end of the Korean War, the Nation’s highway problems again gained attention. With support from President Dwight D. Eisenhower, the financial funding problem for the interstate highway system was resolved among the federal, state and local governments by the passing of both the Federal Highway Act of 1956 and the Highway Revenue Act of 1956. The former called for uniform interstate design standards to accommodate traffic forecasted for 1975 (modified in later legislation to traffic forecasted in 20 years), and the latter provided increased tax and matching federal funds. BPR worked with AASHO to develop minimum standards that would ensure uniformity of design, full control of access, and elimination of highway and railroad-highway grade crossings. These acts resolved several more controversial issues: $1.1 billion was distributed to the various States for the first year of “the greatest public works program in the history of the world.” Bertram D. Tallmy was chosen as the head of BPR, with the newly authorized title “Federal Highway Administrator” to manage the program in 1957, so construction of the interstate system was under way. The next 40 years would be filled with unexpected engineering challenges, unanticipated controversies, and unforeseen funding difficulties. Nevertheless, the president’s view would prove correct. The interstate system, and the Federal-State partnership that built it, changed the face of America.

87 “US Prods Hawaii to Speed Road, Highway Work,” Honolulu Advertiser (Honolulu, HI), November 14, 1949.
ROAD CONSTRUCTION

Road construction, as a means of communication around the Hawaiian Islands, can be traced back to the early kings and chiefs of the islands. It was said that there was a road around Maui which was about 138 miles long and from 3 to 5 feet wide. Most parts of this road were paved with hard beach stones passed from hand to hand by men. Stones were laid crosswise from the support, not in a solid surface but in an arrangement like the squares of a checker board. It is interesting to note that in 1890, under the monarchy, a group of prominent citizens went so far as to volunteer the advancement of amounts necessary to keep a particular highway project going, charging no interest, and trusting the legislature to vote an appropriation.

The catalyst for the great increase in road building in Hawaii after 1920 had its origin in 1924 when the provisions of the Federal Highways Act were extended to the Territory (now the State) of Hawaii by an act of congress in 1924. Since 1926, when the present Federal Aid program was launched in Hawaii, the THD had completed 518.91 miles of highways on the islands of Oahu, Hawaii, Maui, Molokai and Kauai and had maintained these sections. A Federal Aid Highway System upon which projects could be initiated to receive Federal Aid was laid out, consisting of a total length of allowable new construction of 213 miles, of which 118 miles were located on Oahu.

In 1931 and 1932, Congress made emergency appropriations, which resulted in allotments totaling one million dollars to the Territory. This money was to be used to relieve the unemployment situation with construction jobs and used in lieu of funds which states typically provided as their portion of the cost of Federal Aid projects. It created an $880,000 Hawaii Special Fund to take the Federal Aid System within the Territory in 1931. This system was selected by the Governor of Hawaii, and agreed upon by the Secretary of Agriculture, on November 18th 1931, and allowed for the construction of new roads totaling 532 miles in length.

Hawaii had accelerated the speed of other highway constructions since the 1940s with the increasing traffic problem and the national defense need. Highway construction in Hawaii experienced a slow start at the end of the World War II because of material and special engineers’ shortages and high costs. President Truman pointed out, “By any reasonable standard, our highways are inadequate for today’s demands. Future demands will inevitably be greater as business traffic continues to expand, as our population grows, and as we build roads to reach needed resources now relatively inaccessible.” The highway expansion and improvement program was proposed during the late 1940s for the reconstruction, rehabilitation and extension of highways, which would not only provide increased road safety and economic use for motor vehicles, but also ensure the adequacy of roads to serve in time of peace or war.

During the 1950s and 1960s there was a shortage of highways in Hawaii due to the increasing use of motor vehicles and the expanding tourism industry of the islands. Between 1950 and 1958 there was a 36 percent increase in motor-fuel consumption in the State of Hawaii. This average of 4 percent a year was almost the same as the continental increase. The total road mileage in the State of Hawaii had already reached 3,137 miles by January 1958. The island of Hawaii had the most highway mileage of any of the islands and it is also the largest. Most of the mileage of city streets was found on the island of Oahu and in the city of Honolulu. The annual travel on all roads and streets in Hawaii was estimated to be 1,707 million vehicle-miles during 1950-1958. This is based primarily on registration and motor-fuel consumption data. This would amount to an average daily traffic of about 1,530 vehicles on all roads and streets in Hawaii. This compared with similar volumes at the time recorded on all roads and streets of 1,570 vehicles in Connecticut, 1,200 in Delaware, 2,030 in Rhode Island, and an average of 523 for the entire United States.

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88 Ibid.
VIII. MILITARY CONTRIBUTION TO ROAD AND HIGHWAY CONSTRUCTION IN HAWAII: 1959 TO 1970s

HISTORICAL BACKGROUND

Defense activity played a minor role in the Hawaii during the first thirty-five years of Territorial status (1900-1935). Hawaii became a Territory of the United States in 1898, when the world was at peace. Only a “token defense force” was considered necessary in Hawaii at that time. World War I was centered in Europe and also had little effect on military population in Hawaii.

In 1931, a political shift in Japan from a relatively liberal to a militaristic government was followed by a rapid build-up of Japanese forces. Concerns about the intentions of Japan caused a gradual increase in military forces allocated to Hawaii. After Japan’s attack on China in July 1937, American defense activity in the Pacific rose sharply, with Hawaii as a focal point. During the prewar defense program of 1939-1941, federal expenditures in Hawaii steadily rose. By 1941, the military establishment had become the largest employer of civilian workers in the Territory. Armed forces were concentrated in the island of Oahu with major installations at Pearl Harbor, Barber’s Point, Schofield Barracks, and Kaneohe. Following the December 7, 1941 attack on Pearl Harbor, the military government regulated activity throughout Hawaii.

With the commencement of World War II, all construction, including highway construction, was restricted to only that which would materially aid National Defense as stated in General Administration Memo No. 148 from the Washington Office of the Public Roads Administration. The military authorities approved all Federal Aid highways constructed by the THD as strategic. In some cases they insisted that roads be built which were of doubtful value to the civilian population but of great value to the Army, such as the Kunia Road from Schofield to Waipahu.

During the War years (1941-1945), defense activities totally dominated the economic life of the islands and profoundly affected social and political life. Tourists and many unemployed residents were evacuated from the islands. Total employment rates rose sharply, with a large percentage of islanders entering the work force for patriotic reasons. War stimulated trade, construction, and income throughout Hawaii due to the extraordinary increase in defense construction and purchases and demands of servicemen on the islands. Military activity in the Territory remained at high levels until the end of 1946 because of Hawaii’s role in demobilization and in the disposal of war surpluses.

During this period, many men who formerly worked for the road department changed their positions in working for the army on vital defense projects. Meanwhile, most federal road aid funds went to the War Department for use on roads of military value in Hawaii. All requests for road construction in Hawaii, except those initiated by the Navy, had to be approved by the Commanding General, Army Forces Middle Pacific (previously Pacific Ocean Areas, Central Pacific Area, and Hawaiian Department) before construction was approved and funds allocated for the work by the Federal Works Agency.

The period 1947-50 was one of repeated cutbacks. The defense expenditures in Hawaii declined from $224 million in 1946 to $148 million in 1950. The war that started in South Korea on June 25, 1950, had immediate repercussions in Hawaii. 1950 began with a depression and unemployment crisis, and ended with a rapid rise in income and employment which ushered in the boom years of 1951-1952. The Hawaii military establishments for the national defense system were increased due to the Korean War. A total of $1,785,500 was spent in the islands’ military construction projects in 1950. In 1951 another $20 million was given to Territory of Hawaii Military. In the early 1950s, the Army decided that a cross-island road was imperative to the defense of Hawaii.
Even after the cessation of military activities in Korea, defense activity in Hawaii continued to rise because of rising tensions in the Pacific area. Delegate Farrington’s weekly “Report To The People” from Washington declared that “recent events have shown that Hawaii is the proper place to build permanent military strength in the Pacific;” “The life of Hawaii needs to be closely integrated with that of States, in every way, politically as well as economically and culturally. This will all add to our military strength. And this is what the country needs today—and quickly.”

For defense in the Pacific, the military establishment maintained in Hawaii a vast system of facilities, service bases and command posts. Defense expenditures increased from $148 million in 1950 to $271 million in 1953. In 1954, Gen. Mark W. Clark urged to create a Pacific defense organization to help maintain those free countries in the Pacific independence against Communist encroachment. As part of President Eisenhower’s military “new look” in Asia, Hawaii was headed for an even bigger role in the Pacific defense program. By 1955, defense continued to be the largest source of island income and the greatest employer of Hawaiian manpower. These defense activities had a direct impact on the road and highway construction activities of the islands.

The National System of Interstate and Defense Highways was designated by the Federal Aid Highway Act in 1944 to primarily serve national defense. The act originally included only the continental United States. States received Federal Aid for highway construction if the projects were regarded as vital to national defense. Hawaii was not eligible for this aid and the convention of the Western Association of State Highway officials refused to pass a resolution that Hawaii be included in the interstate highway system, even though the War Department designated all of Oahu’s principal highways as “Strategic” in 1941. The Pacific military command promised support to help pass a resolution. The Defense Department also thought that including Hawaii in the system would greatly influence public perception of the National Defense System.

In 1959, Congress authorized Hawaii’s admission to Statehood and plans were underway to remove the 48-State limitation on the Interstate system. This system was extended to the State of Hawaii on July 12, 1960 with the passage of Hawaii Omnibus Bill, Public Law 86-624. The Act provided Hawaii with an initial appointment of Federal Interstate Highway fund for the 1961-62 fiscal years in the amount of $12,375,000. It also provided that subsequent appointments to Hawaii be based on estimated cost of completing the system in Hawaii as compared to the estimated cost of completing the system in all States.

Responding to urgent national defense needs in the 1960s, the Territory of Hawaii accumulated highway deficiencies of $50,000,000 which was ten times the annual construction budget. Highways were being developed at a faster rate than the THD could meet. Seeking additional federal aid was seen as a way to reduce time and money loss, and the destruction of lives and property as a result of inadequate roads and streets. John C. Myatt, the first deputy Territorial Highway Engineer said, “If Hawaii were admitted into the interstate system, $1,100,000 on annually would be available for ‘strategic highway’ construction on a 60 federal - 40 local matching basis, increasing the Territory’s highway construction funds by $1,800,000 a year... It would also put us in line to share in President Eisenhower’s proposed 50 billion dollar defense highway construction program, if Congress makes it into law.”

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90 D. F. Balch, Comparative Report: Nuuanu Valley Tunnel Route vs. Kalihi Valley Tunnel Route, April 5, 1943.
91 “Military Backing May get Federal Aid for T. H. Roads,” Honolulu Advertiser (Honolulu, HI), October 23, 1954.
Compared to the large, flexible construction industry on the mainland, the construction field in Hawaii is small and less varied. In addition, Hawaii is also isolated from the mainland and is subdivided by islands. For these reasons, the impact of defense and military establishment on the road construction in Hawaii over the past several decades has been more vital and direct than on any other activity in the Territory.

The Corps of Engineers, in the United States Army, under assignment by Congress, is charged with the public civil works program to control, regulate and improve river and harbor resources and to plan and construct flood control works. In addition to civil projects, the Corps is also engaged in extensive construction programs for the United States Army and Air Force. When local interests are unable to resolve a situation, local authorities can petition their representatives in Congress for assistance. If the representatives consider the petition favorably, they can direct the Corps of Engineers to investigate the feasibility and economics of correcting the situation.

Before the Corps of Engineers became involved in the development of the defense activities in the Hawaiian Islands, the Honolulu Engineer District had been in operation for approximately 45 years. While some minor improvement work and surveys were accomplished under the direction of Corps of Engineers as early as 1899 in connection with the improvement of Pearl Harbor, the District office was set up in Honolulu on 14 April 1905 under the direction of Lieutenant John R. Slattery.

District Engineers executed fortification and other military works under the direction of military commanders as prescribed in army regulations or other War Department instructions. On July 1, 1940, the hostilities with Japan became one of great activities for the Honolulu Engineer District in the initiation of and planning of vast and ever expanding preparations for an emergency. During this period, the construction activities of the Quartermaster Corps were transferred to the Corps of Engineers. In 1942, all engineer troops and military engineering came under the jurisdiction of the Department Engineer. On March 16, 1942, the Commanding General, Hawaiian Department, was granted “complete jurisdiction over, and responsibility for military construction activities in the Hawaiian Department, including administration of existing construction contracts...”

The United States Army constructed approximately 240 miles of roads in the Territory of Hawaii during WWII as well as helped the road maintenance and repair during wartime. Due to the labor and material shortages, these roads had not been properly maintained by the city and county. In addition to the army’s heavy wartime traffic (these highways and streets were mainly used for military vehicles and heavy trucks engaged in transportation for the army or navy), the military and naval authorities provided financial assistance to cover the cost of road maintenance and reconstruction work to put the highways of the islands in good condition. Today many of these roads are available for civilian use and several have been turned over to the Territory. These highways were built to afford easy access to military reservations because the Army thought that a cross-island road was imperative to the defense of Hawaii in early 1942.

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INTERSTATE ROUTE H-1

The H-1 is the primary and most congested freeway along the south shore of the island of Oahu. It was authorized as part of the Statehood Act of 1960 and is one of three Interstate and Defense Highways in Hawaii to be funded by the US Department of Transportation’s Federal Highway Administration. The Interstate-Defense Highway System for Oahu was approved in principle as part of the Statehood Act consisting of the H-1, H-2 and H-3 freeways.

The first section of H-1 in the Mauka Arterial was opened in 1953 near University Avenue. In 1959 at Statehood, part of the Lunalilo Freeway was opened between Punahou Street and King Street. After 1960, it extended both west and east along the south shore till the completion of H-1 in 1986. In 1967, H-1 first appeared on maps, cosigned as Hawaii State Route 72.

BRIDGES IN THE HIGHWAY SYSTEM

From a functional standpoint, bridges are part of a seamless national highway surface transportation system. The highway engineering community uses several terms to describe what are commonly called “bridges,” such as overpass, separation, and ramp. The bridges to highway miles vary greatly within the various states and are influenced by topography and population. Their boom in the 1950s and 1960s are all due to traffic relief efforts and a “Cold War” defense initiative to move troops and material rapidly across the country in the national interstate highway system that started in the 1950s.

During the late 1960s and early 1970s, a series of disastrous vehicular bridge collapses occurred, causing loss of life throughout the United States. The nation began to focus attention on the decaying state of the civil infrastructure in general, and on the nation’s bridges in particular. In 1970 Congress established a special Federal Aid program to provide up to three-fourths of the funds needed to help meet state bridge renewal needs. The initial funds from the Special Bridge Replacement Program became available in late 1972. The Surface Transportation Act of 1978 extended and expanded the Special Bridge Replacement Program to what is now known as the Highway Bridge Replacement and Rehabilitation Program. At the time, $4.2 billion was appropriated from 1979 through to 1982 for bridge replacement and rehabilitation.

H-1, when initially conceived, was known as the mauka arterial. A tentative route was laid out by Honolulu’s planning engineer, Charles Welsh in 1940-41, which was included in the City and County’s first master plan of December 1944. The arterial was to take the form of a divided highway, “with all grade-crossings eliminated” and no left turns allowed. Also pedestrians were not permitted on the highway, thus eliminating the need for pedestrian crossings, and there would be no utility poles other than the tall standards supporting mercury vapor street lamps.

As laid out by Jack Myatt of the Territorial DPW, the proposed seven mile highway was to run between Middle Street and Old Waialae Road, and the entire project was expected to take fifteen to twenty years to complete.

Grade separation structures (under- or over-passes, i.e. bridges) eliminated intersections and thus allowed traffic to flow unimpeded by traffic lights.

In August 1952, the Territorial DPW awarded the contract for the first phase of the highway, between Old Waialae Road and Isenberg Street to J. N. Tanaka, and in November 1953 awarded the company a second contract for the section of road between Isenberg and Alexander streets. The mauka arterial was the most expensive construction project up to that time in Hawaii, with costs running $2 million a year (forty percent of the Territory’s budget for road construction), with about one third of the costs expended on land acquisition.
The three Ewa bound lanes of the first one mile segment of the *mauka* arterial opened on November 9, 1953. The new highway segment immediately reduced the previous morning rush hour congestion around King Street and University Avenue. The newspapers explained, “A major feature of the new arterial is an overpass spanning University Avenue,”93 and labeled the overpass “an ‘air lift’ answer to one of the city’s worst traffic snarls.”94 The University Avenue part of the expressway also included the Islands’ first on and off ramps allowing Manoa motorists to enter or exit the arterial. The utilization of a bridge to traverse University Avenue was very much a novelty for the people of Oahu, as at the time the Puowaina Bridge was the only bridge on the island to span another road. In addition to the University Avenue bridge, this section of the new highway also included the Palolo-Manoa bridge, which was completed in August 1953. In addition, in July 1956 a pedestrian bridge was opened at Isenberg Street to allow pedestrians safe passage over the arterial, one of the earliest structures in the islands erected for this purpose.

The Kaimuki bound lanes between Old Waialae Road and Alexander Street did not open until January 5, 1954, as they needed to await the completion of an overpass which carried Old Waialae Road over a two lane ramp taking traffic from the arterial to King Street. In April 1955 the half mile second segment of the highway, between Alexander and Keeauamoku, was opened to traffic, five months ahead of schedule. This segment included a bridge to allow Punahou Street to pass over the expressway. In addition, the bridge carrying McCully Street over the new freeway was completed in July 1956, and in September 1960 the Keeauamoku Street Bridge was completed, in anticipation of the freeway’s eventual extension towards downtown.

At the dedication of this segment of the highway Honolulu Chamber of Commerce President Gilbert W. Root recalled that earlier the community debated whether the *mauka* arterial was needed, but now it was plain that it was, and the only question which remained was “How fast can we finish the job?”95 Progress on the new highway was bolstered in 1954, when an additional $700,000 in federal highway funds was appropriated for Hawaii in 1954, thanks to President Eisenhower’s desire to expand America’s highway system. To match the new federal dollars and to have funds to pay back highway bonds Hawaii’s gasoline tax was raised from four cents to five, commencing July 1, 1955. Also in July 1955, the Territorial DPW renamed the *mauka* arterial as the Lunaililo Freeway, in honor of the former monarch, following the suggestion of LeRoy C. Bush, the president of Honolulu Construction & Draying Company. The advent of statehood in 1959 led to the expansion of the Lunaililo Freeway into the H-1 Interstate Highway.

Also, by 1958 planning began on the Ewa terminus of the Lunaililo Freeway. Here, the firms of Belt Collins & Associates and Moffatt, Nichol & Taylor proposed a “three-level grade separation structure”; in other words, a double overpass with Middle Street as the upper most deck and an exit leading to Kamehameha Highway from the middle deck, both of which would bridge the Lunaililo Freeway as it continued straight ahead to merge with Moanalua Road. In addition a ramp coming from Kamehameha Highway would tunnel under King Street to join the eastbound lanes of the freeway. In the following year, 1959, construction got underway on the interchange between the Lunaililo Freeway and the Pali Highway. Designed by Law & Wilson, this would become the first three level grade separation structure to be completed in Hawaii. The Middle Street separation was completed in 1964.

The section between Kalihi and Houghtailing streets, which commenced construction in December 1958, was completed in September 1960. The segment between Nuanau Stream and Pele Street got underway in June 1959 and was finished in May 1962. In November 1960, ground was broken on the half mile between Middle Street and Pinkham Street, which was finished in April 1964. In late 1963 James W. Glover Ltd. was awarded the construction

93 “Mayor Asks Chamber Ban Pali Route,” *Honolulu Advertiser* (Honolulu, HI), November 3, 1953.
95 *Honolulu Advertiser* (Honolulu, HI), April 1, 1955: 1.