HAWAII STATE HIGHWAY 378
(Haleakala Highway)
Pukalani Vicinity
Maui County
Hawaii

HAER No. HI-119

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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

HISTORIC AMERICAN ENGINEERING RECORD

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Location: Pukalani Vicinity
Maui County, Hawaii

U.S.G.S. Topographic map, Kilohana Quadrangle 1991 (7.5 minute series) Universal Transverse Mercator Coordinates NAD 83:

1) 04. 780485. 2298918 – Highway 378 junction with Highway 377.
2) 04. 781857. 2298292 – Exit eucalyptus grove.
3) 04. 783744. 2296969 – Final switchback.
4) 04. 784180. 2297377 – Walled overlook with culvert
5) 04. 784691. 2297745 – Pohakuokala bridge
6) 04. 785467. 2298587 – Waiale bridge
7) 04. 787177. 2299211 – Highway 378 junction with National Park road.

Present Owner: State of Hawaii

Present Use: Vehicular highway

Significance: State Highway 378 is significant for its association with the development of tourism in Hawaii, and at Haleakala National Park specifically, in the early 1930s. Automobile access to the crater made it more viable as a tourist destination and added to Maui and Hawaii's ability to compete with other scenic destinations. State Highway 378 is also significant as a feat of engineering for the time in which it was built. The road was constructed to climb the slopes of Haleakala from an elevation of approximately 3500' to approximately 6700' while avoiding the numerous gulches that run down the mountain. To do this, the road was built with twenty-two switchbacks, allowing it to gain 2500 feet in elevation despite being confined to the width of one ridge. The curves of the switchbacks were super-elevated, the only highway in Hawaii to have this feature at the time.

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Project Information: This report is produced to comply with a stipulation in the Programmatic Agreement executed (November 13, 2009) between the National Science Foundation, National Park Service (NPS), Advisory Council on Historic Preservation, the Hawaii State Historic Preservation Officer and others for

the Advanced Technology Solar Telescope (ATST) project. The ATST is to be constructed at the Haleakala Observatories, adjacent to Haleakala National Park, on land owned by the State of Hawaii and managed by the University of Hawaii Institute for Astronomy. This report photographically documents State Highway 378 and the 90 contributing features (2 bridges, 2 guard rail posts, 2 highway marker posts, 16 CRM walls and 68 culverts) as identified in the following report: State Highway 378 (Haleakala Highway) Historic Evaluation. This report also provides written descriptions of these features. Archival photographs were taken in September and October 2012 by David Franzen, Franzen Photography, Kailua, HI. The field work was conducted in February, September and October, 2012 and the initial report prepared December 2012. The portion of Haleakala Highway inside Haleakala National Park is documented in HAER No. HI-52 and the addendum to HI-52.

Part I. Historical Information:

A. Physical History:

1. **Date of construction**: 1931-33.[1]
2. **Engineer**: Territory of Hawaii Highway Engineer
3. **Builder/ Contractor/ Supplier**: Territory of Hawaii[2]
4. **Original plans and construction**: State Highway 378 is a two-lane, asphalt roadway that extends approximately 10.19 miles between the town of Kula and the Haleakala National Park boundary, where the road becomes a National Park road. The highway's features include two bridges spanning the Waiale and Pohakuokala gorges/valleys and eighty-six culverts, including six box culverts. At the time of construction, the road was approximately 8' in width, with slightly wider sections at curves and bridges, and shoulders of approximately 18" on each side. The road makes its ascent along the Pulehunui ridge for its first seven miles, with twenty-two switchbacks, then travels more or less in a straight line another two miles before a final curve leading up to the start of the National Park portion of the road.
5. **Alterations and additions**: The road, bridges and culverts were widened in a 1965-1971 project, and additional work to upgrade the road and culverts was done in 2001. A box culvert was added at an unknown date. Wooden guardrails were replaced with steel guardrails during the 1960s project, and CRM reinforcing walls were added at the end of some guardrails at the same time. The overall layout and length of the road has remained unchanged.

B. Historical Context:

Information in Sections 1, 2, and 3 below comes primarily from HAER HI-52. Please refer to that document for additional information.

1. **Pre-contact Era Ahupua'a of Pulehu Nui, and Kalialinui**

Haleakala, translated as "House of the Sun" or "House (used) by the Sun" features prominently in Hawaiian legend. From this location, Maui, a demigod, discovered the Sun's path through the sky, and was able to lasso it and convince it to slow its transit of the sky so that Maui's mother could dry her kapa (bark cloth)[3].

Haleakala Crater was a sacred site, and therefore used for religious ceremonies, and was also an isolated location where Hawaiians preferred to inter their dead. Archaeological sites found on Haleakala indicate that the area was also an important destination to Hawaiians for other important activities. These included worship at *heiau* (Pre-Christian place of worship, or shrine), adze-stone quarrying, and hunting for the birds whose feathers were used for a variety of products. One important ritual that is still practiced at Haleakala is the burial of the *piko* (umbilical cord) of newborns. The crater also served as a key link across the east side of Maui prior to, and after the construction of the Kihapiilani Highway (also known as the Alaloa – long road) that ringed the island after the mid-1500s. The trail up to the crater, often referred to as Haleakala Road, was used until construction of the Haleakala Highway, which includes State

[1] Maui News. "Haleakala Road Gets Official US Approval." April 26, 1933: pp 1-2.
[2] Territory of Hawaii Territorial Highway Department "Plans of the Haleakala Road Federal Aid Project No. 5B (44 Sheets)."1929. Title page.
[3] Puaaloa, "The Legend of Maui", 1863, pp 4-6.

Roads 37, 377 and 378, as well as the portion of the highway within the national park, was completed in 1935.[4]

2. Haleakala and Tourism

Some of the first non-Hawaiians to visit Haleakala's summit made the trek up the mountain in 1828 over a trail that was considered long but very easy. These missionaries made a record of their visit and their impressions of the beauty of the views from the summit. In 1841, the area was mapped as part of the United States Exploring Expedition. The expedition party included the cartographers, several missionaries, the missionaries' Hawaiian students and a number of Hawaiian guides.[5]

Tourist travel to Haleakala was negligible, even until 1881, when the trip was made by a Scottish travel writer, Constance Gordon Cumming. During the 1890s, however, tourism to the islands picked up, and Haleakala was considered Maui's premier tourist attraction. The trip up the mountain was made by horseback, and until 1894, there were no accommodations at the summit, so travelers needed to bring all they needed for the duration of the trip, and stay overnight in "Flea Cave" before making the return journey.

In 1894 a rest house was built at the edge of the crater at the summit, providing shelter for visitors. Organized tours began in 1901, established by W.O. Aiken, who owned a home in Olinda, a rural area just outside of the ranching town of Makawao. Aiken continued to run his tour business until 1931, four years before the road opened. During this period, Jack London visited Haleakala, giving it still more exposure when he wrote about the experience. In 1903, an article in the Maui News noted that twenty tourists had visited Hawaii the previous week, with three coming to Maui, and went on to call for the construction of a road to the summit to draw more tourists to Maui.[6] By 1912, Maui was in competition with Hawaii Island for tourists, and the argument was made again in the Maui News that a road to the summit of Haleakala like the one to the caldera at Kilauea would help Maui to compete.[7]

3. National Park Status

Kilauea on Hawaii Island received more visitors than Haleakala, and had done so at least since a road was developed to the crater at Kilauea, prior to 1912. In 1916, Hawaii National Park was established by the NPS, which included both Kilauea and Haleakala. At this point, the NPS spent much more attention on the Big Island section of the park because the Haleakala section's boundaries spread well beyond the property that was actually owned by the NPS. Agreements were still needed with the owners of the land within the boundaries of the Haleakala section of the park for the NPS to acquire that land, expand the park, and construct a road to the summit.

The superintendent of the Hawaii National Park made his first visit to Haleakala in 1924. The first ranger was not assigned to the section until 1935, after the road was complete. It was at approximately this same time that the NPS began improvements to the Haleakala section

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[4] "Story of Haleakala Trail." Public Access Trails Hawaii. http://pathmaui.org/wp-content/uploads/2011/04/Story-of-HT.pdf.
[5] Duensing, *Historic American Engineering Record Haleakala Highway HAER No. HI-52,* 1999, pg. 16.
[6] "Some Notes", *Maui News,* March 7, 1903, pg. 3.
[7] Stevenson, V.L., "Road to Haleakala", *Maui News* , 1912, pg. 2.

including a clean-up of the guest house, repair of established trails, and the construction of new ones. An enclosed observatory, two public toilets (comfort stations) and an office and checking station at the park entrance were completed in 1936. Shelters for hikers were constructed in the crater the following year. In 1961, the two sections of the park were split into separate parks, becoming Volcanoes National Park and Haleakala National Park.[8]

4. Development of the Haleakala Highway

The full road leading from the town of Kahului to the summit of Haleakala is a 37-mile stretch commonly known as the Haleakala Highway. Kahului was the location of Maui's most significant port, as well as one of its earlier airports, and was historically the major point of embarkation for visitors to the island. The entire highway is composed of three segments, State Highway 37, from Kahului to Pukalani, State Highway 377 (also known as Kekaulike Highway), from Pukalani to Kula, and State Highway 378 (also known as Crater Road) from Kula to the boundary of Haleakala National Park. The portion surveyed for this report was State Highway 378, which is approximately 10 miles in length. State Highway 378 was constructed between 1931 and 1933 as part of a joint project between the Territorial Highway Department, the Federal Highway Department and the NPS to provide easier access to the top of Haleakala for visitors. It was believed that easier access would allow Maui and Haleakala to better compete with the other section of Hawaii National Park on the Big Island. Prior to the construction of the highway, visitors were able to access Haleakala Crater only by horseback or hike up the Haleakala Trail, which took a great deal of time and often required a guide. A major part of the agreement by the NPS to construct the upper park portion of the road was that the Territory of Hawaii, with the help of federal funding, agreed to construct the road that would connect the park road with the rest of Maui's highways. State Highway 378 was intended to connect Kekaulike Highway where it ended to a proposed NPS road that would terminate at the summit of the crater. The NPS did not want to commit to construction of a road without commitment from the Territory or County to construct the approach road. (The history of the road within the park is available in HAER No. HI-52, located at the Library of Congress).

The planning process to get the road constructed was lengthy, taking nearly thirty years. As early as 1903, newspaper articles in the local Maui News had called for construction of an automobile road to the summit of Haleakala. By 1915 the argument had been made through articles and editorials in the paper that the route through Kula was the best option for the placement of the road even though the earlier trail known as the Haleakala Road went through Olinda (Kula was considered a better option due to its location on the drier side of Haleakala's slopes). Using Territorial convict labor was considered during this time as well, due to its success on the Island of Hawaii in building the road to the crater. In 1916 the Territory declined to fund a survey of possible routes for the road, and the construction of the road was put on hold indefinitely. Though actual construction was postponed, the interest in a road to the summit did not diminish. In 1917 Alexander Hume Ford, a well known Hawaii promoter, wrote a letter published in the Maui News stating that Haleakala was a greater attraction than Kilauea on the Island of Hawaii. He also called for the construction of a road to the crater at the top of Haleakala, as well as a hotel at the end of the road. An editorial published in the paper the same day agreed.

A number of issues plagued the road idea. Between 1912 and 1916, the main problem was to convince the Territorial government to spend the funds to build the road. Additionally, there was

[8] Duensing, *Historic American Engineering Record Haleakala Highway HAER No. HI-52,* 1999, pg. 1.

disagreement over whether the project should be a Territorial or a County project. An editorial in 1917 pointed out that prior to the establishment of county governments, Maui had contributed taxes to the construction of hundreds of miles of roads on the other islands, while Maui's own roads had been built later under the county system, without the benefit of funds from other islands. The argument followed that since the Territory would benefit from the tourist income generated by an easy route to Haleakala, the Territory should contribute to building the road. For the Territory and County, other more commercial roads took precedence over the road to the summit at this point. For the NPS, the main problem was that much of the land within the park boundary and along the proposed road route, was privately owned. In 1923 the U.S. Congress passed a bill allowing the Territory of Hawaii to receive federal appropriations for road building, which meant that if the Territory now allocated funds to the approach road, the federal government would match those funds at a certain percentage.

During the majority of the 1920s, the Maui News continued to advocate for a road to the summit, with support from various members of the Maui community, and, at times, from other counties as well. By 1928, Maui County was secure enough in its belief that funds would soon come through for the road's construction that it commissioned a survey of a potential route for the road up to the national park's boundary. In 1929, the Associated Chambers of Commerce, a group of representatives from each island's chamber of commerce, passed a resolution supporting a territorial expenditure to construct the road. According to the Maui News editorial about the funding,

> "the federal government will go 'fifty-fifty' with the territorial government to the extent of $15,000 a mile on the road built…it is figured that if the territorial government puts up $300,000, the federal government will furnish $260,000…And on top of that the NPS of the Federal government will build the road from the connecting point to the summit of the mountain and the rim of the Crater. That is estimated at not less than another $300,000. So it is apparent that the Territory will receive in aid for the building of the approach and in the construction of the park road nearly two dollars to one of federal assistance and road construction. It is too good a chance to be passed up."[9]

In May of 1929, the Territorial Legislature passed the funding measure, allocating $300,000 for the construction of the approach road.

Plans for the approach road were drawn up and approved by the Territorial Highway Engineer by October of the same year. According to the plans, Upper Kula Road would be rebuilt, and straightened, and at Pulehunui ridge, east of Pohakuokala gulch, a new road would begin up toward the park boundary. The new road climbed Haleakala over a total of 10.185 miles. It did this in a series of switchbacks along Pulehunui ridge, from approximately 3500' elevation, up to an elevation just below 6000' in its first seven miles with twenty-two switchbacks, then began a gradual climb over an approximately two mile straightaway before curving around Puu Nianiau in its last mile to reach the park boundary just above 6700' elevation. Over the entire length of the approximately ten miles of road were eighty-six pipe culverts, six box culverts, two cattle grates, and two bridges[10]. After reassurances from the NPS that construction would begin on the part of the road within park boundaries as soon as the approach road was complete,

[9] "Maui's Major Project", *Maui News*, February 9, 1929, pg. 3.
[10] Territory of Hawaii Territorial Highway Department "Plans of the Haleakala Road Federal Aid Project No. 5B (44 Sheets)."1929, pp. 4-31 & 10A.

construction began in June, 1931, was complete on April 2, 1933, and opened to drivers that same month.

When it was completed in 1933, the road was eight feet wide macadam pavement with eighteen inch shoulders on either side, the curves and bridges were 10-12' wide, and frequent pull-outs were provided for cars to pass. The curves were super-elevated (higher on the outside of the curve than at the inside) to enhance safety, and it was the only highway in Hawaii to do so. In addition, the 30,000 cubic yards of stone used to create the foundation beneath the road's paving was made from "the hardest ever used in Hawaii"[11] until that time. (It is unknown what type of stone was used, however.) Once the foundation of stone was in place, the macadam asphalt was laid from the top of the road to the bottom. The road was finished with mortared stone curbing and shoulders, and painted wooden guard rails. Water was diverted along and below the roadway with a series of ditches and culverts, with culverts constructed almost "every 100 feet".[12] In addition to the culverts, two bridges were constructed in the upper section of the road to cross larger gulches, one spanning 110' at Pohakuokala Gulch, and the other 63' at Waiale Gulch.

The NPS completed the portion of Haleakala Highway in the park boundaries in early 1935, and held a large opening ceremony on February 23, 1935. On opening day, 1,639 people made the trip to the summit of Haleakala, and the park has remained a popular attraction to visitors and locals alike since.

During World War II, the park's use was limited, and the military made use of the summit, so traffic on both the approach and park road was reduced as well. Just after the war, when the park was again reopened to regular use, improvements were needed along the entire road to the summit. The park began an improvement program within their boundaries in 1950 that lasted until 1959, and complained that in comparison to their portion of the road, the approach road was in poor repair.

The state did not begin repairs until the mid-1960s. In the mid- to late-1960s, the state began a program of widening and repaving the approach road, mainly concentrating on the curves, but also extending the road's culverts. Additionally, steel guard rails were installed during this project. In 1971, the two concrete bridges were widened to match the newly widened road. No major projects were undertaken on the road between 1971 and 2001 when the road was resurfaced, and the culverts were again modified. See section 5.0 Table 1 which provides the estimated and known construction and modification dates for each feature.

Part II. Structural/ Design Information:

A. General Statement:

1. **Character**: State Highway 378 is a feat of engineering at the time of construction in the early 1930s, climbing over 3000' up the slopes of Haleakala, while avoiding most if the area's many gulches by use of super-elevated switchback curves. The overall layout of the road remains the same as it did at the time of construction.
2. **Condition of Fabric**: Good.

[11] "Haleakala Road Gets Official US Approval", *Maui News*, April 26 1933, pp. 1-2.
[12] Ibid.

B. Description:

Features of Hawaii State Highway 378 leading from Kula up to the Haleakala Highway in Haleakala National Park include the roadway itself, culverts, box culverts, two bridges, cattle guards, retaining walls, and several other drainage-related and non-drainage related features. The highway traverses 10.185 miles and extends from an altitude of 3300' at the junction of Highway 377, to an altitude of 6500' at the entrance to Haleakala National Park.

Roadway

The lower portion of State Highway 378 in the Kula area has numerous residences and small businesses along both sides of the road. Driveway intersections are frequent, and private fences and gates are a common feature along the roadside. There were houses in this area when the road was constructed in 1931-1933, but there are more houses now, and they are located further up the road than was the case at the time of the road construction.

The road has twenty-two switchbacks up to approximately the 5,800' elevation, then a long, relatively straight stretch, followed by one last switchback before the National Park boundary at about 6,500' elevation. Most of the switchbacks are deeply cut into the earth at the roadside, The lower residential portion of the road has fairly steep embankments (up and down) on both sides or the road. This, in combination with a great deal of high vegetation, generally does not allow views out towards the lower areas of the island. However, after passing through a Eucalyptus grove at the 4,200' elevation level, buildings and trees along the road disappear altogether and views of the island saddle and west Maui are prominent.

Original drawings for the 1931-1933 road construction are dated 1929. The paved portion was typically 8' wide, with wider curves that were between 10'-12' wide. The paving included a 2" surface course and 4-1/2" base course. A 12" stone header was installed along each edge of the roadway. Along steeper slopes on the downslope side of the road, lava rock rip rap set in concrete mortar was typically installed. At the location of tractor crossings, 30' lengths of ½" diameter reinforcing bars were placed in the paving. Wood guardrails painted white were installed along the entire road.[13]

Many portions of the road were widened between 1965-1970. Road widening at first entailed increasing the width of the road by 8' on the inside of sharp curves, during the 1965-1966 portion of the project. The stone header on the side of the road that was being widened was removed. Six inches of untreated base was installed and 1-1/2" of "A.C. Mix No. V" was installed on top. The stone header on the upper side of the road that was left in place during this widening was not found during the survey for this report, and is not believed to be extant. The 1965 drawings also include details for new road delineators and reflector markers. The 1967-1969 project widened the straight portions of the road by the same amount the curves had been earlier. Finally, in 1970, the two bridges were widened to 29' deck width. The resulting width on the entire road was approximately 20' at the roadway with 3' - 4' shoulders, and 29' wide bridges.

In 2001, a project began that mostly entailed improvements to the culverts, but some road improvements also were undertaken. These include installing a bituminous gutter at the side of the road paving in some areas. This gutter often had a 4'x8'x12" concrete masonry rubble "riprap"[14] blanket at the lower end. In addition, some of the guardrails were replaced. The overall width of the road was not changed at this time, and retains the widths established in the 1960s projects.

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[13] "Haleakala Road Gets Official US Approval", *Maui News*, April 26 1933, pp. 1-2.
[14] Terminology used in 2001 drawings.

Culverts

The original 1929 pipe culverts were constructed with corrugated metal pipes (CMP) or concrete rectangular (box) interiors. The pipe culverts typically had concrete (or cement) rubble masonry (CRM) head walls at each end, some possibly with drystack basalt rubble wing walls. The corrugated metal pipes varied in diameter from 1'-6" to 4'-0". Some culverts had a box-shaped pit at the inlet constructed of CRM.

Most, if not all, of the culverts were extended in the 1960s road widening project. Some culverts were extended on the inlet side, while others were extended on the outlet side. Typically, only one side of each culvert was extended. Details from historic drawings show that the existing CRM headwalls were to remain; the stones at the top of the headwall were removed, and a new reinforced concrete collar was constructed adjacent to the headwall to connect the new pipe. A new CRM headwall was constructed at the end of the extension. Headwall dimensions vary depending on the size of the CMP. Pipes used for the extension were either standard CMP or "CGSM"[15] arched pipes. The CGSM arched pipes were used to extend concrete box culverts. At some locations, box-shaped drop intakes were installed, which were constructed of CRM with a corrugated metal pipe outlet.

Many of the culverts were modified in the 2001 Road Repairs project in various ways. Some culverts were extended and some were not. Some culverts had either the inlet or outlet headwall replaced, others had both replaced, while some culverts were left unchanged. New inlets installation included either a new CRM headwall, a concrete headwall or a concrete drop box with a grated inlet.

When modifications and extensions were made, both in the 1960s and 2001, the diameter of the CMP was matched, and remains consistent at each of the culverts, ranging from 1'-6" to 4'-0".

Culverts modified in 2001, typically have either "U" shaped CRM headwalls at inlet and outlet, or concrete drop box grated inlets with CRM outlet headwalls. All of these headwalls use random courses of angular blue basalt and have a concrete cap approximately 2" thick. The walls vary in height and length, but are typically about 2' thick. In many cases, only one side was modified in 2001, and the opposite side retains a different appearance.

The 1960s modifications were less uniform than those in 2001, with some CRM headwalls, and some concrete headwalls. CRM headwalls generally consist of smoother basalt courses, with thinner basalt cap courses. They sometimes have sidewalls, but more frequently are simple straight walls. The width of these walls is typically about 2'. These walls also vary greatly in length; most are only a few feet long, but one is approximately 50' long.

The majority of these culverts are unremarkable, but two have unusual CRM walls. The first is the inlet wall at feature 115C. This wall appears to have been extended at its top with river rock stones with little visible mortar between them. Unlike other inlet and outlet walls, which are more frequently "U" shaped or straight, this inlet wall is curved into a wide arch. Another unique wall is the outlet wall at feature 179C. This wall is similar construction as most other 1960s walls, but is approximately 50' long, and of unknown width. It has a comparatively small culvert pipe of about 42".

Box Culverts

[15] As called out in 1968 drawings. CGSM is not defined, but is believed to stand for Corrugated Steel Metal Pipe.

The box culverts were constructed of reinforced concrete, with rectangular-section concrete-lined bores and masonry headwalls. Culverts having an interior dimension of 3'x5' were constructed with walls 9" thick, and culverts having an interior dimension of 4'x5' were constructed with walls 10" thick. Box culvert headwalls were constructed with rubble masonry paving around the top and sides of the culvert opening. The distance that the concrete floor extended out past the opening varied, depending upon the slope of the wall at that area and the slope of the culvert floor. Alterations to the original construction made in the 1960s and in 2001 are described below.

Box culverts generally have concrete headwalls, and vary in size. The largest is approximately 4'x6', and was extended at both ends, the outlet side during the 1960s project with an arched corrugated metal pipe, and the inlet side during the 2001 project with a cast concrete extension, and CRM headwall with sidewalls.

The 1965 project extended every large box culvert, using CGSM pipe, while the 2001 project only extended a few box culverts, using cast concrete headwalls, and CRM sidewalls in some places. The box culvert that best shows the progression of changes from the 1930s concrete box construction, the 1960s CGSM addition, and the 2001 concrete addition is feature # 182 in which the alterations were made at only one side, sequentially.

Bridges

Two bridges, at Waiale and Pohakuokala Gulches, were built during the 1931-33 construction of the road. Their design shared the same construction type, which consisted of integrated reinforced concrete girders and beams, deck platform, curb, and parapet. The Waiale Bridge has one central, arched support pier made of board formed concrete, while the longer Pohakuokala Bridge has two arched support piers of the same type of construction. The piers have square concrete footings, above grade at Waiale Bridge, and below grade at Pohakuokala. The concrete parapets had a recessed panel appearance at both sides which was changed when the bridges were widened. Both bridges originally had a clear roadway 12' in width.

The bridges were widened in 1971. The existing bridge structures were retained, except that the concrete curb and parapets were removed. The new bridge section was installed adjacent to the existing bridge, on the upstream side. The new bridge sections have three reinforced concrete I-beam shaped girders, and are not supported by piers. The reinforced concrete deck is covered with asphalt paving. The parapets are concrete with a metal railing on top, have a different appearance than is shown in the construction drawings, and are approximately 3' high. The new curbs and parapets were installed at both sides of the bridge deck, one on the new bridge and one on the existing bridge deck. Both bridges maintained their original lengths of 93' at Pohakuokala, and 63' at Waiale, but were widened to 29' roadways.

Cattle Guards

The original cattle guards installed in the 1929 construction project were built using railroad rails 12' long. The cattle guards have all since been modified. Notes on the 1969 drawings indicate "existing cattle guard to be widened and reconstructed" at Features 197 and 214.

The cattle guard at the top of Highway 378 (Feature 223) appears to be older than the other cattle guards along the highway. HAER HI-52 indicates that this cattle guard was installed in 1996.[16]

The present cattle guards still use railroad-type rails. The rails are approximately set atop "W" or "I" beams and are reinforced with flat metal strips that are approximately 5" wide and installed crosswise over the rails. The rails and beams sit over a pit in the road approximately 2' deep. Either side of the cattle guards also has triangular-shaped side-walls made of wooden boards that stand at an approximate 45 degree angle to the road, preventing cattle straying around the guard. The cattle guards' typical overall size is 30' wide across the highway, and 8' long along the road.

Retaining Walls

Retaining walls of CRM are found at the ends of the guardrails in several locations. These walls retain the embankment at the roadside where steep cuts were made to accommodate the roadway. They are typically rectangular, and are typically 4' x 5', though some walls are smaller and others larger. Some are nearly parallel to the road surface, while others are more nearly perpendicular. These retaining walls appear to have been constructed during the 1960s road widening project, though plans do not call them out specifically.

Guard Rails

The road currently has metal guardrails. The 2001 Road Repair drawings indicate replacement of the guardrail in some areas. Most of the metal guardrail looks relatively new and was likely installed within the last two decades.

Research indicates that guardrails were originally wood: A historic photograph of the road[17] shows wood guard rails along both sides of the roads. In addition, a Maui News article of 1933 says that wood, white-painted guardrails lined the entire road[18]; and the 1960s road widening project drawings indicated "existing wood guard rail" in several areas. The 1968 drawings indicated removing at least one section of the wood guard rail.

CRM at Shoulder

Small areas of CRM lava rock paving were installed at the shoulders of the highway in 2001.[19] They are typically located on the lower end of a bituminous gutter at the side of the road that was constructed during the 2001 project.

Other Features

Six small concrete posts were found along of Highway 378. Two had been removed from their original locations, had fallen down embankments, and were found nearby other features, so

[16] National Park Service, *National Park Service Cultural Landscapes Inventory Haleakala Highway Haleakala National Park.* 2008, pg. 26.
[17] Hawaii State Archives, S. L. Padgett photograph. July 1959.
[18] "Haleakala Road Gets Official US Approval", *Maui News*, April 26 1933, pp. 1-2.
[19] Original plans referred to these gutters as 'riprap." CRM is a more correct term, as these features are constructed with mortar.

were not given feature numbers. Feature 100T is a concrete road marker found at the junction of highway 378 with highway 377. It is approximately 1'-6" tall and 8" square, with chamfered edges. The number "378" is painted in white paint on one side. Feature 212.1T is a concrete post approximately 26" tall and 5" square with chamfered edges. It has four holes that pass through the post, indicating it may have been a railing post. Feature 218 is a concrete post that resembles Feature 212.1T. It has two holes that are visible, but also pass through the post, indicating it was likely a railing post also. The two sides that do not have the holes flare out convexly. Feature 222 is a concrete road marker. It closely resembles Feature 100T in size, and has the same paint markings. It is located at the junction of highway 378 with the National Park portion of the road. The construction dates for these features are not known.

C. Site Information:

The road begins in a relatively well populated area of housing and small business in the town of Kula, and travels up the slope of Haleakala into an area entirely free of housing, used only for pasture. The setting of the road remains much as it was at the time of construction. The lower 2 ½ miles of road is lined with houses and views are blocked by trees and other foliage. The next 6 ½ miles are mainly pasture, and the final mile, is lined with pine trees before meeting up with the National Park portion of the road.

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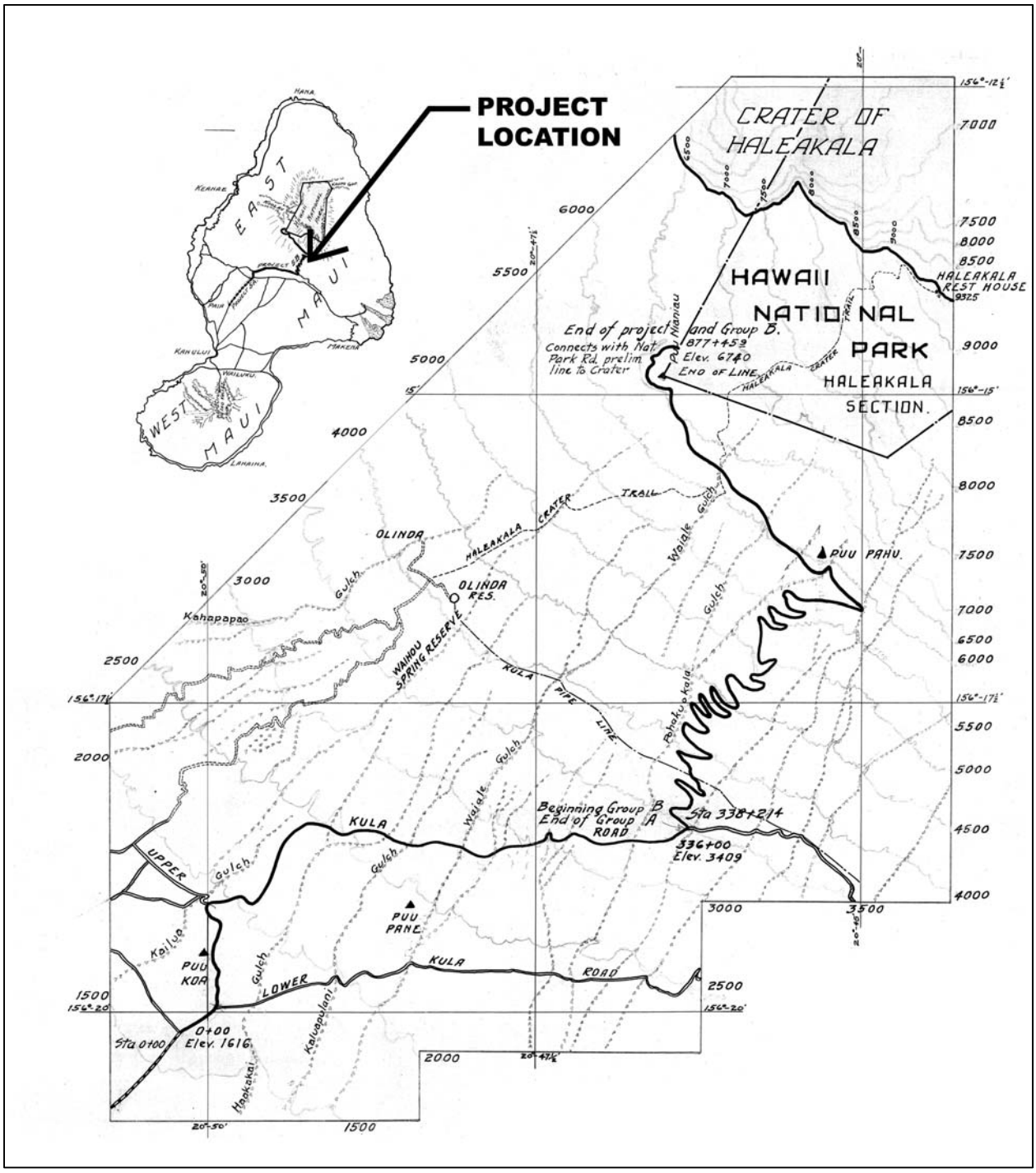
Location Map



Portion of aerial photo dated 1965 showing Highway 378 shortly before the first alterations were undertaken in the 1960s (added arrows). No scale.