



# KAUAI

## WAINIHA BRIDGES PROJECT, KŪHIŌ HIGHWAY, ROUTE 560



## General

During the Draft Environmental Assessment (EA) public comment period which ran from April 23, 2016 to May 23, 2016, numerous comments were received from the public regarding the Wainiha Bridges Project. Major comment themes included a focused on the Draft EA project title, the intent of the project, project design elements, and the typical section of the proposed replacement structures. The purpose of this document is to address these comments in a concise and holistic way. This analysis is being provided to the organizations and individuals that provided comments on the Draft EA. These include the Hanalei Roads Committee, Hui Ho Omalu I Ka Aina, Bob Terao, Carl Imparato, Jonny Wichman, Wendy Wichman, Glen Mickens, Mike Dennis and the 123 individuals who signed the *Petition to Stop the Wainiha Bridges Project*. The Central Federal Lands Highway Division (CFLHD), will include this response as well as the supplement data included herein into the appropriate sections of the Final EA.

## Major Public Comment Themes

The purpose of this memorandum is to clarify the Intent of the Wainiha Bridges Project, provide additional information regarding design criteria, and provide an update of the Wainiha Bridges design in light of the public comments received. As identified in the Draft EA, the primary purpose of the project is to replace the three temporary Wainiha bridges (referred to as Wainiha Bridges 1, 2, and 3) to maintain continued access along Kūhiō Highway. Additional issues (secondary project purposes) have been identified through engineering evaluation and agency and public outreach. These include the following:

- Improve operations;
- Manage maintenance requirements; and
- Balance project improvements with the character of the historic roadway corridor.

The bulk of the public comments received fall into one of the below comment categories:

- 1) Draft EA Title and Project Description Mischaracterize the Project. Commenter's identify the project as a rehabilitation project. Commenter's request that we amend the title of the DEA ("Project to Replace Temporary Wainiha Bridges") to reflect the communities' intent to rehabilitation of the historic Wainiha Bridges. Numerous references were made to HDOT's October 2012 Engineering Design Report for the Rehabilitation of Wainiha Bridges.
- 2) Design should include replication of Historic 1957 Bridge Design as much as possible. Design considerations for Width, Decking, and Railings should be discussed further.
- 3) Why aren't two lane structures proposed given the ADT?

## Draft EA Title and Project Description Mischaracterize the Project.

The Wainiha Bridges project has a long history. The Wainiha Bridges have been an aspect of the Kauai Belt Road for over 100 years. Throughout this history, they have suffered numerous failures and emergency conditions warranting their repair, reconstruction, and eventual replacement with temporary Acrow structures erected in 2004 and 2007 under emergency conditions. The most recent history includes the 2004 demolition of the historic steel king post truss Wainiha bridge number 2 and its replacement with a temporary Acrow panel bridge under a September 22, 2004 governor proclamation. In 2007, Wainiha Bridge number 3 was damaged and a load test was performed by HDOT on Wainiha Bridges number 1 and number 3. The results of this load test lead HDOT to reduce the load limit to 3 tons. Again due to safety concerns on October 29, 2007, the Governor signed another proclamation for the demolition and removal of the historic queen post Wainiha bridges number 1 and 3 bridges with temporary Acrow Panel bridges.

As summarized in the National Register nomination for the three historic Wainiha Bridges (#1, #2, and #3) these structures were unique in Hawai'i. Designed to be built quickly and inexpensively, the bridges were an expedient response to the destructive 1957 tidal wave that stranded residents on the west side of the Wainiha River. The county Department of Public Works wasted no time designing new bridges to reconnect the north shore communities, and plans were ready within weeks. The designers used materials that were readily available and had been traditionally used on Kaua'i, including: steel I- beams, 12" lumber for decks, and 2" x 4"s for railings. Almost fifty years later, the bridges are an important feature of the North Shore's rural landscape and an integral part of its historic belt road.

Since the 2004 and 2007 emergency Wainiha bridges replacements, the Wainiha Bridges project has been identified as a project to rehabilitate the Wainiha Bridges. The 2012, Hawaii Department of Transportation (HDOT), Kauai District Engineering Design Report (EDR) was titled Kūhiō Highway, Rehabilitation of Wainiha Bridges Project (2012, HDOT EDR). Furthermore, the Statewide Transportation Implementation Plan (STIP), lists the project as the *Kūhiō Highway (Route 560) Bridge Rehabilitation, Wainiha Stream Bridges #1, #2, #3*.

The FHWA defines "rehabilitation" as "the project requirements necessary to perform the major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects." Furthermore, the definition of "rehabilitation" related to the Secretary of Interior's Standard in 36 CFR 67 is as follows: "Rehabilitation means the process of returning a building or buildings to a state of utility, through repair or alteration, which makes possible an efficient use while preserving those portions and features of the building and its site and environment which are significant to its historic, architectural, and cultural values as determined by the Secretary." Unfortunately, the three Wainiha bridges reached a level of structural deficiency that was beyond rehabilitation, they were deemed unsafe, condemned and replaced in 2004 and 2007. As summarized in the *Guidelines for Historic Bridge Rehabilitation and Replacement*, prepared by the American Association of State Highway and Transportation Officials (AASHTO, 2007), "Not all historic bridges can be saved, but many can. Preservability of a historic bridge, as with any bridge, is a factor of its ability to perform adequately, which is defined by engineers as meeting current minimum standards or guidelines in the areas of load capacity (structural), geometry (functional), and safety." The AASHTO 2007 report goes further to establish guidelines for how to evaluate historic bridge rehabilitation / replacement. "Historical significance must also be a major factor in the decision-making process, including whether the bridge is of such significance that a higher level of effort to preserve it is warranted. If a bridge can be improved to an acceptable level in a prudent manner, within the limits of acceptable technology and without adversely affecting what it is that makes it historic, then the bridge is likely a viable candidate for rehabilitation."

The FHWA has avoided using the term "Rehabilitation" for the Wainiha Bridges Project, because it does not conform the typical definition of a bridge rehabilitation project and could be confusing to the general public and permitting agencies needing to take action on this project. The emergency response taken in 2004 and

2007 resulted in an adverse effect from the removal of the three historic Wainiha bridges. Since the bridges are no longer in place and the main character defining features were removed with them; the term rehabilitation is inappropriate to use since no major character defining remnants of the bridge remain or are able to be reused under the proposed action. However, the FHWA-CFLHD recognizes that the overall property, the Kaua'i Belt Road, is a significant historic site (NRHP site reference # 03001048, and Hawai'i State Inventory of Historic Places [SIHP] # 50-30-02-9396) and that the three historic 1957 Wainiha bridges were considered contributing elements to the road's historic integrity. Therefore the removal of the temporary Acrow Bridges with replacement bridge structures that echo the historic character of the 1957 bridges which adhere to the Secretary of Interior's Standards for such a replacement can be considered rehabilitation to the Kaua'i Belt Road National Register-listed historic property. Throughout the project development process, the FHWA-CFLHD has and continues to treat this as a rehabilitation project in terms of the four Secretary of Interior Standards and Guidelines for the treatment of historic properties (Preserving, Rehabilitating, Restoring, and Reconstructing) for the larger Kaua'i Belt Road historic property. However, characterizing the project as solely a bridge rehabilitation project is an inaccurate description of the project because no part of the bridges are able to be repaired or altered as is typical for rehabilitation projects which preserve those portions or features which convey its historical, cultural, or architectural values. We do agree that the Kaua'i Belt Road as a historic property is being rehabilitated because features of the three contributing Wainiha Bridge properties have been destroyed or lost. We initially considered naming the EA "Kūhiō Highway Rehabilitation Project" but did not because it implies improvements to stretches of roadway beyond the scope of the project and could also lead to misunderstanding of the project's intent. Because of the potential for this confusion, it was decided that the title should focus on the three Wainiha bridges and that "replacement" would be appropriate and would not cause confusion because it would not mischaracterize the project. Reconstruction was also considered and would be appropriate from a transportation standpoint but this terminology was also avoided due to potential confusion with the four treatment standards as an exact reconstruction of these three historic structures has never been HDOT's intent for this project as indicated in the 2012 HDOT EDR report.

Since the initial 2004 replacement of Wainiha Bridge number 2, HDOT initiated various communications and information gathering for the project from the public, state historic preservation division (SHPD), and interested parties. This information gathering effort culminated in the 2012 HDOT EDR report. This report was considered the first phase of a two phase process. Phase I was identified as a Conceptual Design / Community Involvement phase where a Context Sensitive Solution for the project could be identified. Phase II was identified as the National Environmental Policy Act and Chapter 343, HRS 200— Environmental Assessment process and Design Phase. The phase 1 2012 HDOT EDR concluded with several key findings and design recommendations for the replacement bridges and that continued coordination would occur during the phase 2 process. Throughout project development, the FHWA-CFLHD has initiated coordination with the SHPD, interested parties, and the public regarding the replacement Wainiha bridges. The FHWA-CFLHD has attempted to provide a Context Sensitive Design for the replacement bridges which meets the intent of the 2012 HDOT EDR recommendations and project purpose and need. The Context Sensitive Design is discussed further within this report.

To improve clarity of the proposed project FHWA is updating the name of the EA to the following: "Wainiha Bridges Project (Replacement of the Temporary Bridges and Rehabilitation of Kauai Belt Road). We have further clarified/summarized this change within the EA's introduction,(project history, section 1.2.3) to describe the rehabilitation of the Kauai Belt Road aspect of the project as it relates to historic preservation. Further discussion of the rehabilitation of the Kauai Belt Road considerations of the project have been included in the cultural resources, Section 3.10 of the EA.

## Context Sensitive Solutions and Context Sensitive Design Considerations for the “Rehabilitation” of the historic Kauai Belt Road through replacement of the Wainiha Bridges.

Given the historical significance of the pre-ACROW 1957 Wainiha bridges and the Governor’s Proclamation in 2007 that acknowledged the need to balance safety requirements with historic preservation; a Context Sensitive Solution (CSS) approach has been employed to identify a range of alternatives addressing bridge design considerations including materials, width, and aesthetic considerations in comparison to the project purpose and need and current design standards (i.e. AASHTO, KHRCP). The Federal Highway Administration (FHWA, 2007) defines CSS as a collaborative, interdisciplinary, approach that involves all stakeholders in developing a transportation facility that complements its physical setting and preserves scenic, aesthetic, and historic and environmental resources while maintaining safety and mobility. Context Sensitive Design (CSD), on the other hand, applies to a transportation project's engineering design features, and may include features that help the project fit harmoniously into the community (e.g., aesthetic treatments, color matching, or curbing details). In general CSS focuses on ensuring that designs are balanced with setting, significant resources, and transportation needs. It is an approach that leads to preserving and enhancing scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions. It puts project needs and both agency and community values on a level playing field and considers all tradeoffs in decision making. Often associated with design in transportation projects, CSS should be a part of all phases of program delivery including long range planning, programming, environmental studies, design, construction, operations, and maintenance. The CSS approach is guided by four core principles:

1. Strive towards a shared stakeholder vision to provide a basis for decisions.
2. Demonstrate a comprehensive understanding of contexts.
3. Foster continuing communication and collaboration to achieve consensus.
4. Exercise flexibility and creativity to shape effective transportation solutions, while preserving and enhancing community and natural environments.

The CSS approach recognizes that criteria spelled out in various manuals (State Standards, AASHTO Green Book, Road Design manuals etc.) are not all typically clearly defined for new single lane bridge projects attempting to find a balance between safety and historical value. However, these standards need to be considered during the development process, and design exceptions or variances from these standards should be pursued if it can be shown that there are minimal documented safety issues, or if there are safety concerns that can be effectively mitigated.

For projects such as the Wainiha bridge project, an attempt to meet even the minimum criteria could result in unacceptable impacts to the historical value of the road and adjacent environment, resulting in a need to use criteria lower than those specified as minimum acceptable values in accordance with AASHTO. The AASHTO 2007 guidelines for decision making in historic bridge rehabilitation/replacement project were established to specifically address historic preservation and engineering issues in a manner that reflects the appropriate balance between the two seemingly divergent objectives – preserving old bridges and maintaining a safe, efficient transportation system. Below is a discussion on the bridge design elements of the historic 1957 bridges and our CSD considerations for balancing these elements with current design requirements for the replacement structures.

### Bridge Width

Throughout the prior HDOT project engagement (2008 to 2013) and the on-going public outreach (2014-Present) with the local community, project stakeholders and the regulatory community; consideration of bridge width has been an element of continuing discussion. Due to the historical significance of the Wainiha Bridges and the Kauai Belt Road, the local stakeholders would prefer permanent replacement structures that closely matching the historic bridge widths. However, because it is HDOT’s mission “To provide a safe,

efficient, accessible and intermodal transportation system that ensures the mobility of people and goods, and enhances and/or preserves economic prosperity and the quality of life”, a goal of the project is to achieve a balance of this historical context with other factors such as current design standards, safety, and functionality while minimizing impacts other sensitive environment resources.

The original Wainiha bridges, Bridge 1 and Bridge 3, were constructed in 1904. In 1924, an alternate stream channel for Wainiha Stream was created during a storm and an additional bridge was required. This new bridge, Bridge 2, was completed in 1931. By 1966, all three of these bridges were replaced due to damage as a result of destructive storm events. The previous Wainiha Bridges (before the ACROW Panel bridges) were built approximately sixty years ago. Those bridges were built as a temporary solution in response to the devastating tsunami in 1957. They did not meet today’s design standards and were not envisioned to handle the volume and vehicular loading of today’s traffic along Kūhiō Highway. The bridges that were constructed in 1957 and 1966 had the following dimensions:



**Figure 1. 1957 Bridge 1 – Approximately 42-feet in length and 11-feet in width.**



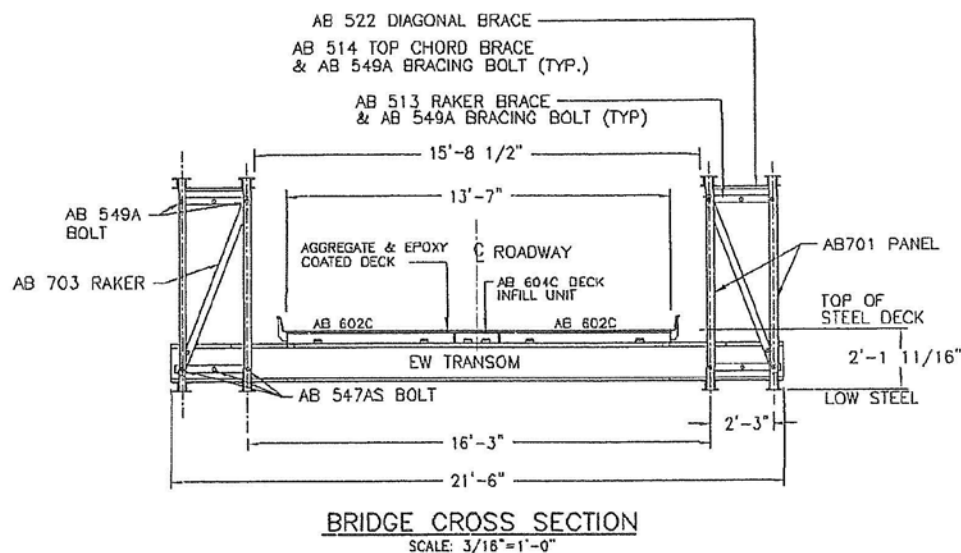
**Figure 2. 1957 Bridge 2 – Approximately 78-feet in length and 10-feet in width.**





**Figure 3. 1957 Bridge 3 – Approximately 146-feet in length and 11-feet in width.**

When these three bridges were again damaged by storm events, the Governor signed a proclamation on September 22, 2004 and another one on October 29, 2007, allowing these bridges to be replaced with temporary Acrow bridges. The 2007 proclamation stated that the design of the permanent repairs had been delayed *“by the need to balance safety requirements with concerns regarding historic preservation and community preferences for maintaining the horizontal alignment and single lane nature of the Bridges”*. The bridges were replaced with temporary ACROW bridges in 2004 (Bridge 2) and 2007 (Bridges 1 and 3). Figures 4-6 below show the as-built typical sections for the existing Acrow Bridges.



**Figure 4. Acrow Bridge 1 – 14 feet wide travel way**

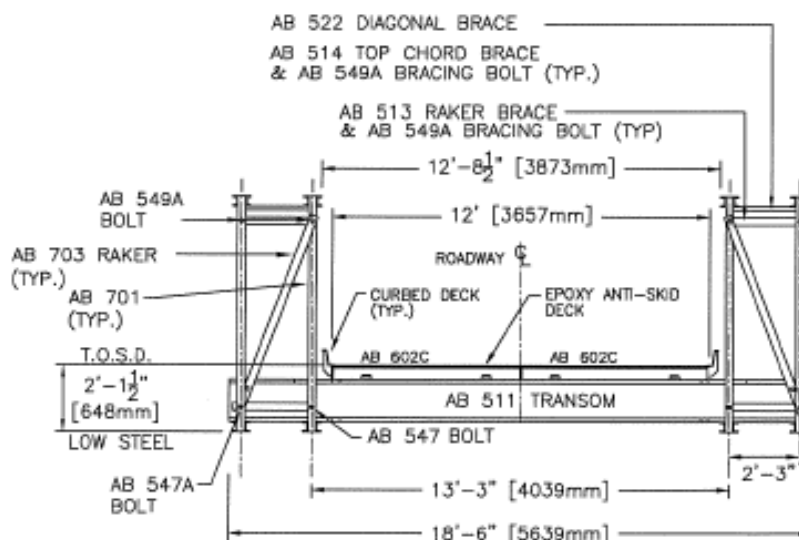


Figure 5. Acrow Bridge 2 – 12 feet wide travel way

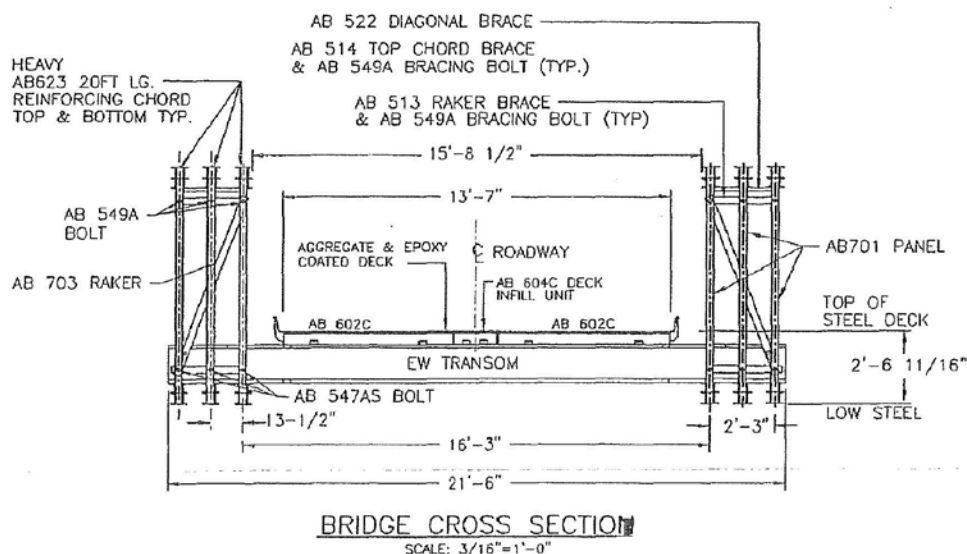


Figure 6. Acrow Bridge 3 – 14 feet wide travel way

Following installation of the temporary bridge #2 in 2004, HDOT began working with a local consultant, AECOM, to identify long term engineering solutions for permanent replacement of the temporary ACROW bridges; with the goal of finding a CSS that would balance the historical value to the safety needs of a modern facility. Included in this effort was extensive public outreach that started in 2005 and continued through 2012, when the Engineering Design Report (HDOT 2012 EDR) was completed. Through the stakeholder outreach, it became apparent the public had a strong preference towards preservation of the historical context of the road by matching the alignment, widths, and aesthetics associated with the 1957 and 1966 bridges. The results of the 2012 HDOT EDR report recommended an 11-foot wide bridge for Bridge 1 and 16-foot widths for Bridges 2 and 3. The 2012 HDOT EDR stated that *In keeping with community preference and to maintain as much of the character of the rehabilitated bridges as possible and in accordance with Kūhiō Highway (Route 560) Historic Road Corridor Plan (KHRCP), the rehabilitated bridges will be of one-lane construction. The single lane bridge design does not meet AASHTO standards and will require a design exception. The rehabilitated for Bridge #1 will have a maximum of 11-foot width consisting of one travel lane. Bridges #2 and #3 will have a maximum of 16-foot clear width, including one 11-foot wide travel lane and a 5-foot wide bike/pedestrian lane.*

The EDR report goes on to state that: *However, Hanalei Roads Committee (HRC ) and the local community prefer to have a width less than 14-foot wide, while HDOT recommends a 16-foot width. The community's reasoning for the narrower bridge width is for traffic calming, and to adhere to the historic nature of the roadway. All parties have agreed to continue working out a solution during the design and environmental permitting phase (Phase II) of the project.*

The 2012 HDOT EDR report concluded with the following determination: *However, HRC and the local community have not accepted the proposed alternatives. The primary point of disagreement involves the bridge width for Bridges #2 and #3. HRC prefers to have a width less than 14-foot wide, while HDOT, FHWA, and AASHTO standards require a 16-foot clear width, as set forth in the KHRCP. At the January 26, 2012 Public Meeting conducted in accordance with Section 106 Procedures of the National Historic Preservation Act and the National Environment Policy Act (NEPA), the local community insisted upon 11-foot wide bridges as they existed before removal in 2004 and 2007. The community's reasoning for the narrower bridge width is for traffic calming, and to adhere to the historic nature of the roadway. The parties have agreed to continue working out a solution as we work through the Section 106 Process and the Environmental Assessment.*

In 2013, Central Federal Lands Highway Division (CFLHD) entered into a Memorandum of Agreement (MOA) with HDOT to provide for delivery and construction of the Wainiha bridge replacement project. After extensive review of available information, CFLHD formally initiated the environmental compliance process with public meetings held in December 2014 and March of 2015. A common concern expressed by the public at these meetings was that the community wanted reassurance that the work previously completed was not lost and the design process was not starting over.

On April 23, 2016 the Draft EA was released for public comment. The Draft EA presented a proposed bridge design for three permanent one-lane bridges with a 14-foot roadway section from rail to rail, with an additional 1-½ feet on each side to support bridge rails and for hanging utilities. During the public comment period 15 agency and public comments were received and petition entitled The "Petition to Stop the Wainiha Bridge Project" was circulated by concerned citizens. One hundred and twenty three signatures were obtained as part of the Wainiha Petition. The Petition read as follows:

*As residents of Hanalei we are interested in preserving and protecting our home. We live in Hanalei because of its country lifestyle and a way of life that is rapidly disappearing in other parts of Hawaii. Kauai is being squeezed by pressures to develop our area by the tourism industry and other developers. We feel it is our duty to protect the Hanalei lifestyle for future generations.*

*The Hawaii Department of Transportation has decided to replace the three bridges in Wainiha. Currently these three bridges are **11 feet wide**. The HDOT proposes to increase the width of these three bridges to **14 feet wide**. This is unacceptable for the following reasons: If we allow HDOT to make the 3 Wainiha bridges 14 feet wide it will allow tour buses to access our beaches and parks in Haena and Kee. This will forever change the peaceful tranquility and country feel of this area. It will allow massive development in Kee. It will change the area from rural use to a tourist Mecca . We are strongly opposed to widening the 3 bridges. We want them kept as is. If the bridges need to be upgraded for safety, we ask that the community's wishes be obeyed, and the historical nature of the 3 bridges remain. The community wants 11 foot wide bridges.*

Unfortunately, this petition did not provide a clear comparison of the existing Acrow bridge widths versus the proposed bridge widths. For the last nine years (Since the 2007 replacement) the Wainiha Acrow Bridges have accommodated a 12-foot minimum (Bridge 2), single-lane bridge roadway typical section (Figure 5). Additionally, the temporary Acrow Wainiha Bridges 1 and 3 currently have a 13-foot 7-inch



single-lane bridge typical section as identified in Figures 4 and 6. The proposed action as presented within the Draft EA would make the bridge widths uniform for all three bridges at 14-feet.

The public comments received during the Draft EA public comment period was consistent with public input shared in the 2012 HDOT EDR. The community preference is towards maintaining the historical and rural nature that is unique to the North Shore of Kauai with new single lane bridges that replicate the 1957/1966 bridges. However, there was also a small minority that expressed interest for improving operational characteristics with consideration of a two lane bridge alternative with widths that would more effectively accommodate vehicular access, emergency vehicle access, maintenance vehicles, and trailers. A summary of the primary issues identified by the public is described below:

#### Operations

- The Acrow bridges don't function as well as the older bridges. It is more difficult to see across the bridges with the Acrow bridges. The rails are too high, with tighter spacing, the roadway and bridges are higher, and vegetation becomes overgrown and is not well-maintained.
- It is not uncommon for two vehicles to enter the bridge from opposite sides at the same time and one have to back up. Road rage sometimes occurs.
- Ensuring safe ingress and egress is important. Emergency vehicle access is necessary, with consideration of width, load capacity, and ability to withstand storms. Safe access in an emergency is important.
- Speeds are a concern. Narrow bridges help to keep speeds low. Wider bridges make people go faster and it becomes more unsafe.
- The high project ADT of >3,200 vehicles per day (per the 2012 HDOT EDR), many of which are tourists don't seem to be familiar with navigating the one-lane bridges of the north shore.

#### Maintenance Considerations

- Vehicles repeatedly hit the timber rails on the older bridges. This required repairs and replacements.
- Timber decking and railing experience increased wear and/or rot from the high use and the corrosive saline environment, which results in periodic repair and replacement.
- The ACROW bridges require bolt tightening and corrosion protection.
- Vegetation often becomes overgrown and is not well-maintained. This affects visibility.

#### Construction Impacts

- Impacts to the stream and estuary need to be adequately addressed and minimized.
- Traffic impacts during construction are a concern.

### **Evaluation of Bridge Widths for the Wainiha Bridge project**

Based on the variety of standard recommendations identified, stakeholder input, and the information presented in the 2012 HDOT EDR; CFLHD wanted to ensure the replacement Wainiha bridge design was consistent with a CSD will meeting minimum design standards. CFLHD evaluated standard design guidance to evaluate both one lane and two land bridge design standards before developing the proposed fourteen foot (14') Wainiha bridge design. This design attempts to balance community desires with minimum acceptable design standards and the stated project purpose and need. The following describes the evaluation approach and the bridge widths considerations made by the FHWA-CFLHD:

#### **Single Lane - Two Way Bridges**

A review of the reported crash history does not indicate an abnormal safety situation (either on the previous one lane bridges or on the current one-lane ACROW bridges), despite ADT significantly exceeding the Low Volume Road threshold. Over the eleven years of crash data provided by HDOT (from 2000 to 2011), there

have been approximately 17 crashes in the vicinity of the bridges. Of these 17 crashes, there have been zero fatalities and five injury crashes. Only one crash occurred in the last four years of the data analyzed. The standard AASHTO design criteria and guidelines, as it relates to new construction of one lane bridges, typically requires that one lane bridges only be considered for low volume roads (ADT <400 vpd). A design exception is warranted for the three Wainiha bridges due the higher volumes estimated for the route. However, it should also be noted, that the bridges in the Hanalei area are all single lane, two directional bridges, and the new bridges would be consistent with the driver expectancy for the historic route.

### **Single Lane – Two Way Bridge Width Considerations**

Single lane bridge width design parameters are another consideration where traditional design standards are not clearly defined with consideration of site-specific historical context. Available guidance found through various nationwide sources suggests varying approaches by Land Management Agencies (LMA) to address challenges with replication of historical bridge widths while maintaining an acceptable level of engineering standard; from simply using the AASHTO Policy for highway bridges to development of Land Management Agency-specific policies to address the historic bridges they own and maintain. The following are a few of the guidelines/policies identified during our guidance review:

#### **New York Department of Transportation (Geometric Design Policy for Bridges Appendix 2B):**

*“When all requirements have been met, and when a final decision has been made to replace an existing one-lane bridge by another one-lane bridge, and when Design Approval, specifying that decision, has been obtained, the structural design normally shall produce plans for a bridge 14 ft. wide between railings, except that the replacement shall not be narrower than the existing one-lane bridge. Minor variations are permissible to account for the intricacies of particular structural components.”*

#### **National Park Service – Park Roads Standards (1984)**

*“The total roadway width (including shoulders for low volume, one-lane roads should not exceed 14 feet because of the tendency of drivers to use a wider facility as a two lane road.”*

#### **USDA Forest Service Design Guidelines (FSH 7709.56b) (2014)**

*“Most National Forest System (NFS) road bridges carry low-volume, low-speed traffic. Most of AASHTO’s design specifications and standards are written for higher-speed, higher-volume roads.”*

Furthermore the Forest Service guidance states:

*“Use a 14-foot width as the minimum clear distance between traffic barriers for bridges, cattle guards, and other single-lane road structures. Use widths greater than 14 feet to accommodate curve widening, off-highway vehicles, and minor deviations (up to 2 feet) resulting from using standard modular structural units. Ensure that a single-lane bridge does not create the appearance of two lanes of traffic.”*

#### **AASHTO’s A Policy on Geometric Design of Highways and Streets (2011)**

The minimum roadway width for new and reconstructed bridges should match the approach roadway width for Design volumes over 2,000 vehicles per day.

#### **AASHTO’s Guidelines for Geometric Design of Very Low-Volume Local Roads (2001)**

*“One lane bridges may be provided on single lane roads and two lane roads with ADT less than 100 vehicle per day where the designer finds that a one-lane bridge can operate effectively. The minimum width of a one lane bridge should be 4.5m (15ft) unless the designer concludes that a narrower bridge can function effectively (e.g., based on the safety performance of similar bridges maintained by the same agency)”*

## Kūhiō Highway (Route 560) Historic Road Corridor Plan (KHRCP)

As summarized in the 2012 HDOT-EDR, a document entitled *Kūhiō Highway (Route 560) Historic Road Corridor Plan (KHRCP)* was prepared to provide a guideline for project planning on the Kūhiō Highway. The KHRCP “Introduction” summarizes the report as follows:

*“This planning document has been developed to provide the Hawaii State Department of Transportation (HDOT), Highways Division, with a framework for decision making and actions on Kūhiō Highway, Route 560. It focuses on a specific concept for the highway involving rural-historic road design intended to protect the corridor’s natural and historic conditions and characteristics. The provisions of this document do not apply to all HDOT highway facilities, but only to the Kauai District office and the management and operations of Route 560.”*

*“The HDOT will specifically use this document as a working plan to provide the necessary direction for current and long-term actions regarding preservation, rehabilitation, restoration, reconstruction and improvement, and repair and maintenance work on Route 560 over the next 25 years.”*

The KHRCP serves as a community framework for HDOT Highways Division – in regards to Kūhiō Highway. The corridor plan addresses specifically one-lane bridges and states: *“Replacement of any one-lane bridges should:*

- 1) be reconstructed, as much as practical, with bridge similar in design;*
- 2) have a single 12 feet-wide travel lane and 2 feet-wide shoulders;*
- 3) have parapets or rails that are designed to be in character with the existing one-lane bridges along Route 560;*
- 4) accommodate pedestrian/bicycle access within or outside of the bridge;*
- 5) have a posted load of 15 tons and be capable of accommodating 18-ton fire trucks and other public utility or service vehicles; and*
- 6) incorporate AASHTO guidance on crash-tested features.”*

The Hanalei Roads Committee (HRC) is comprised of members who contributed to the KHRCP from the Kūhiō Highway Community Advisory Committee. In meetings held with HDOT and the HRC during phase I of the Wainiha Project, it was conveyed that the bridge guidelines in the Corridor Plan were to be used as a framework, and that subsequent design could deviate slightly from the KHRCP.

The KHRCP planning level document was prepared in an effort to establish guidelines for improvements to the historic Kūhiō Highway Corridor. Recommendations from the report suggest that one lane bridges be replaced with one 12’ lane with 2’ shoulders (16-foot wide bridges). Despite the recommendations provided from this document, the local stakeholders feel the Hanalei area is a unique district along the Historic Kūhiō Highway Corridor and further consideration should be made with regards to width of the new bridges to more closely match the historic width.

## Bridge Width Evaluation

The FHWA-CFLHD evaluated 4 bridge widths before developing the proposed bridge design alternative as presented within the to the April 2016 draft EA. Below is a summary of the bridge width evaluation conducted by FHWA-CFLHD.

### 11-foot wide bridge

- This bridge width was presented in the EDR as the preferred width for all of the Wainiha Bridges expressed by the local community and the Hanalei Roads Committee as it more closely matches the historic/previous bridge widths and the narrower widths help to slow traffic. The EDR also recommended this width bridge for Bridge #1. The local stakeholders feel that the narrow one-lane

bridges are part of the pace, lifestyle and culture of the area. They are part of what makes the area so special and unique.

### 13-foot wide bridge

- This bridge width was included as an alternative in the evaluation to compare against for functional use, verifying the design vehicle can maneuver the bridges without damaging the approach rails.

### 14-foot wide bridge

- This bridge width was selected for evaluation as it matches AASHTO's guidance with regards to single lane road widths. It was also selected as a preferred alternative in a letter to HDOT from the HRC, indicating 14-foot wide bridges would be considered acceptable. However, this letter was later redacted in a follow up letter dated February 27th, 2012 where they indicated a preference for 11-foot bridge widths.

### 16-foot wide bridge

- This bridge width was presented in the 2012 HDOT EDR as the recommended bridge width for bridges 2 and 3.

For comparative purposes and with consideration of the draft project purpose and need, the above bridge widths were evaluated against the following criteria:

#### 1. AASHTO Controlling Design Criteria (for documentation of design exceptions)

Road Classification: Rural Arterial

ADT: >3200 vpd (per the EDR)

Design Speed / Posted Speed: 25mph

Design Vehicle: AASHTO SU-40

Accident History: 11 year review of HDOT data (No abnormal safety situations)

- Bridge Width- Match existing approach roadway width
  - Lane Width (Travel-way) – 22-foot (11 foot lanes)
  - Shoulder Width – Minimum 8-foot shoulders
2. **Functionality** – To evaluate the functionality of the different bridge widths, AutoTurn (design engineering software) was used to simulate the design vehicle's tracking movements (front overhang and tires) as it travels the proposed roadway alignment. The design vehicle identified and agreed to during project scoping is a single unit truck (AASHTO's SU-40), a 39.5 foot single unit vehicle similar to a delivery truck. A passenger car towing a boat trailer was also evaluated, but the single unit truck has a larger turning radius and is therefore the controlling design vehicle.

Shy distance (the distance from the edge of traveled way to the face of the barrier) was also considered under functionality. FHWA guidance recommends a minimum of 2 feet be provided (Section 8.5.3.3.4 of the Project Development and Design Manual).

3. **Maintenance** – Maintenance was considered a critical evaluation criterion due to the potential long term commitment of maintenance funding necessary to support the preferred alternative. To evaluate anticipated maintenance of the various bridge widths, anecdotal evidence was used based on feedback from both the public and HDOT district staff.
4. **Pedestrian and Bicycle Safety** – Although the bridges will not be designed to fully accommodate pedestrians and bicycles, their safety is still a consideration in the width of the Wainiha bridges.

See the below Table 1 for an evaluation of the different bridge widths evaluated against these different measures:

Table 1. Bridge Width Considerations

		11 ft (10-foot lane, 0.5-foot shoulders)	13 ft (11-foot lane, 1.0-foot shoulders) Note: Lane widths could be striped at 10-foot for traffic calming and added pedestrian refuge)	14 ft (11-foot lane, 1.5-foot shoulders) Note: Lane widths could be striped at 10-foot for traffic calming and added pedestrian refuge)	16 ft (11-foot lane, 2.5-foot shoulders) Note: Lane widths could be striped at 10-foot for traffic calming and added pedestrian refuge)
AASHTO Controlling Criteria	Lane Width	Design exception required	Meets AASHTO standard	Meets AASHTO standard	Meets AASHTO standard
	Shoulder Width	Design exception required	Design exception required	Design exception required	Design exception required
	Bridge Width	Design exception required	Design exception required	Design exception required	Design exception required
Functionality	Design Vehicle (Verifying the design vehicle can successfully navigate the bridge)	Does <u>not</u> accommodate design vehicle at bridges 2 and 3.	Accommodates design vehicle	Accommodates design vehicle	Accommodates design vehicle
	Shy Distance	Does not meet recommended guidance	Does not meet recommended guidance	Does not meet recommended guidance	Meets recommended guidance.
	Level of Service	Unchanged	Unchanged	Unchanged	Unchanged
Maintenance	Maintenance (related to width only)	Anecdotal evidence confirms that the bridge rails get hit by larger vehicles at Bridges 2 and 3, requiring frequent maintenance.	Maintenance of bridge rails is anticipated to be reduced as bridge width widens.	Maintenance of bridge rails is anticipated to be reduced as bridge width widens.	Maintenance of bridge rails is anticipated to be reduced as bridge width widens. .
Pedestrian and Bicycle Safety	Pedestrian and Bike Safety	At this width, pedestrians and bicycles would have to walk in the travel lane.	Pedestrians and bicycles have very little room to move if a vehicle enters the bridge at the same time.	In the event that a pedestrian or bicyclist is using the bridge, it provides them some refuge if a vehicle enters the bridges at the same time.	In the event that a pedestrian or bicyclist is using the bridge, it provides them some refuge if a vehicle enters the bridges at the same time.
Miscellaneous	Miscellaneous	Closely matches historical widths			Could be perceived as a two-lane road, reducing overall safety for vehicles and pedestrians and bikes in the event that they use the bridge.



During design development, the FHWA-CFLHD also reviewed the design of the historic 1957 Wainiha Bridges to identify a suitable replacement structure design. The proposed design recommendations discussed within the 2012 HDOT EDR served as a starting point for developing the draft Wainiha Bridges design. Though the 2012 HDOT EDR recommended bridge widths vary slightly from the 14 foot bridge (See Figure 8 Below) width presented in the April 2016 EA, CFLHD proposed the 14 foot width because it is a CSD which best meets standard one lane bridge design standards while not being excessively wide (See Figure 7 below), thereby minimizing the effect to the scale of the historic bridges within their historic landscape.

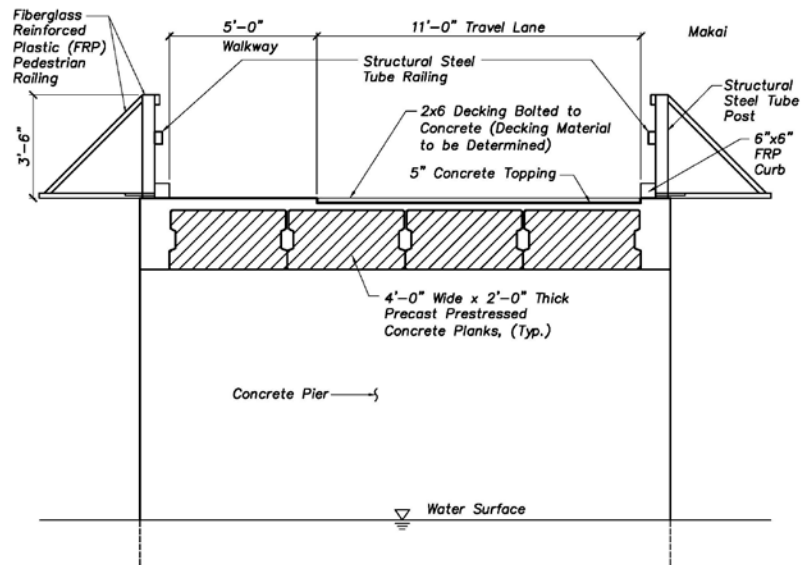


Figure 7. 2012 HDOT EDR Preferred Design Rendering

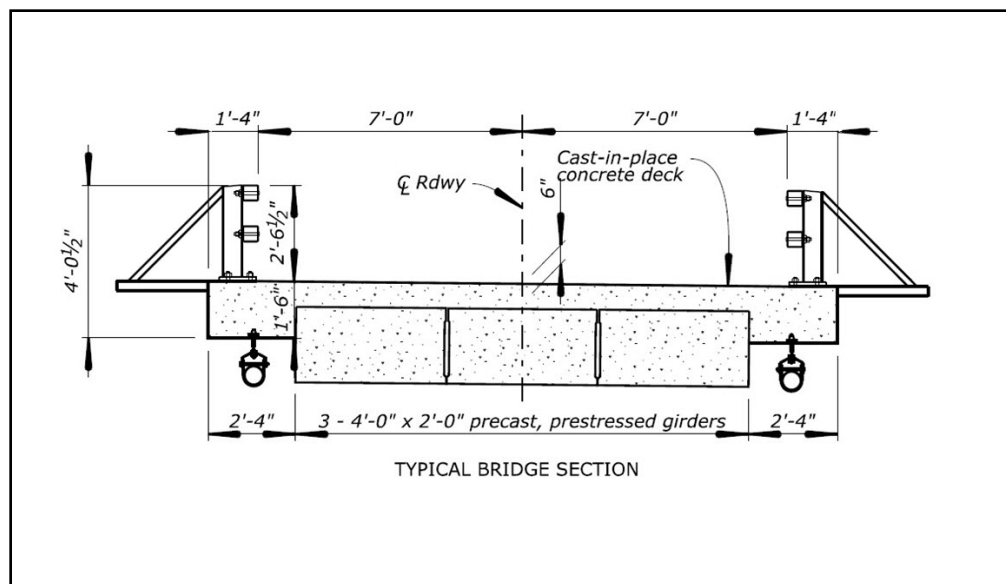


Figure 8. Proposed Typical Section from Draft April 2016 EA (Figure 2-1).

## Bridge Deck and Rail Design Considerations

Additionally, the 1957 Wainiha bridges contained several key design elements that were to be considered as aesthetic treatments for the replacement Wainiha Bridges. These elements included the decking material, pedestrian and vehicle railing, and end treatments. The 2012 HDOT EDR stated that bridge decking will be designed to mimic the placement of the timber planking on the previous bridges. Replacement design will incorporate timber or timber facsimile for the traveled way surface. The public has commented numerous

times on wanting to replicate the unique look, feel and sound of the historic Wainiha bridges. It is well documented that in a wet environment such as that found at the Wainiha Bridges, timber planks experience increased wear and/or rot. This results in a need for replacement periodically, which adds considerably to HDOT's maintenance workload and material costs as well as major traffic stoppages during such repairs. Additionally, the CFLHD has also received design recommendations from the National Marine Fisheries Service (NMFS) on other similar bridges near the Kauai coast. The NMFS has recommended that CFLHD avoid the use of metal (e.g. copper) and pressure treated lumber (e.g. creosote) and further ensure that materials used for the bridge or retaining walls are nontoxic to aquatic organisms. Copper leaches from metal treated wood while polycyclic aromatic hydrocarbons leach from wood treated with creosote. Avoiding the use of these types of treated wood products would avoid or minimize potential adverse effects to human and fish health within adjacent aquatic habitats. As presented in the April 23, 2016 draft EA, the FHWA-CFLHD initially proposed a cast in place concrete bridge deck that was treated with a timber-like appearance. This design was intended to provide a timber facsimile (through color and surface application and treatment) for aesthetic purposes while reducing maintenance costs and addressing aquatic resource concerns raised by the NMFS. However, following the public comments that support a bridge design that replicates the timber deck of the 1957 Wainiha Bridges; the CFLHD has spent the last few months redesigning the Wainiha bridge to include a true timber deck. The proposed Wainiha Bridges now include a timber deck made from 4 inch by 12 inch treated lumber installed longitudinally as was present on the 1957 historic Wainiha bridges (See Figure 10). This design revision is presented in figures 9 through 12 below. The EA is being updated to present the modified bridge deck design.

Additionally, it was documented within the 2012 HDOT EDR that all replacement Wainiha bridges will utilize vehicular and pedestrian compliant railings. The 1957 bridge railings consisted of a simple 2x4 lumber design. It was assumed in the EDR that the proposed rails could use Structural Steel Tube (SST) Railings for the replacement bridges that comply with Test Level 2 (TL-2) of the AASHTO standards while mimicking the aesthetics of the 1957 bridges. Railing picket spacing was also discussed as a desire to mimic the original 1957 Bridge railing spacing has been expressed by the local community. During design development, the FHWA-CFLHD elected to utilize the SST railing as recommended within the 2012 HDOT EDR report to restore the visual aesthetic of the historic 1957 Wainiha bridges rails while ensuring rail crashworthiness and maintenance objectives are met for the replacement structures. As is shown in Figures 9 through 12, the proposed SST railing is aesthetically similar to the 1957 bridges, while meeting current crashworthiness standards. The SST has similar rail picket spacing and is slightly shorter than the 1957 railings to improve sight distance on the bridges.

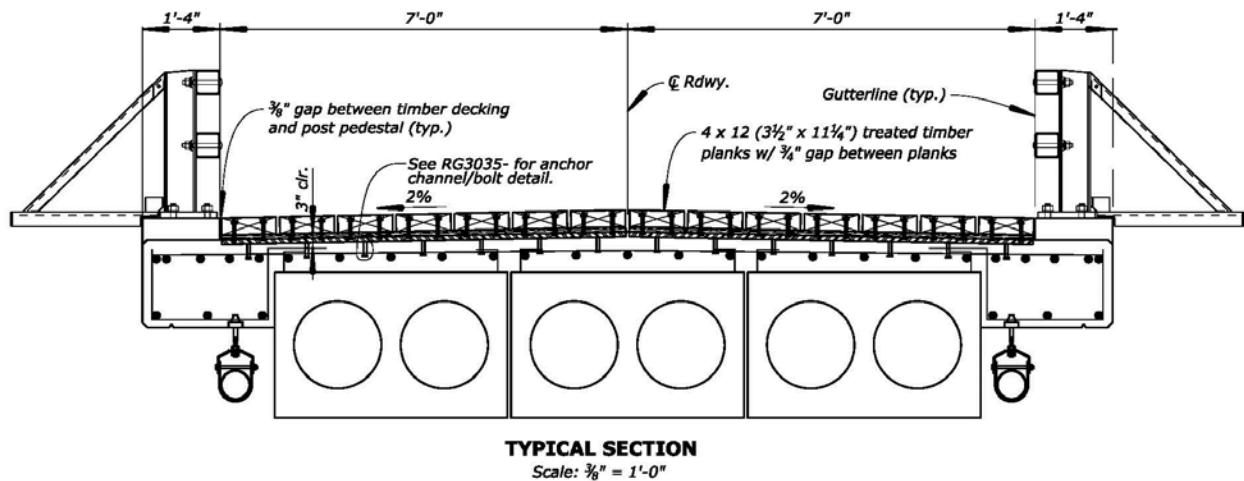
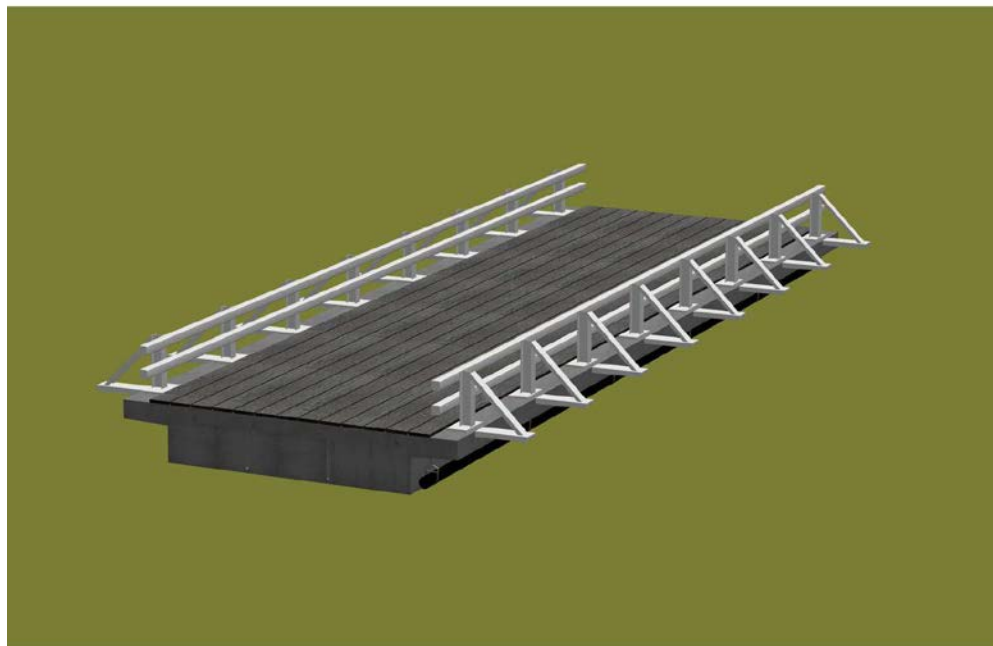


Figure 9. Modified Proposed Typical Section with Timber Deck.



**Figure 10. Bridge 3 Pre Acrow Replacement.**



**Figure 11. Visual Rendering of Modified Timber Bridge Deck.**



**Figure 12. Visual Rendering of Modified Timber Bridge Deck.**

## Conclusion

The CFLHD in partnership with the HDOT is committed to balancing community and transportation needs for the Wainiha Bridges Project. CFLHD believes that the modifications made to the proposed bridge design as presented in this report and to be included in the forthcoming EA updates would provide replacement Wainiha bridges that would satisfy the projects purpose and need, are consistent with nationally recognized design standards for a roadway with this Average Daily Traffic all the while providing aesthetic design treatments which echo the historic Wainiha bridges which will complement this segment of the historic Kaua'i Belt Road.

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