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January 31, 2017

Mr. Frank DeMarco P.E.  
Director of Public Works  
County of Hawaii  
Department of Public Works  
101 Pauahi Street, Suite 7  
Hilo, HI 96720

Subject: Hakalau Stream Bridge (#29-3)  
Structural Condition Survey Report

Wesley R. Segawa & Associates (WRSA), conducted a field visit on January 13, 2017 to observe the condition of observable portions of the Hakalau Stream Bridge for the purpose of rendering a professional opinion regarding the structural condition of the bridge at the time of our visit.

This field visit was conducted after review of the following documents provided by the County of Hawaii (COH):

1. Original construction drawings, specifications and miscellaneous contract documents (circa 1929).
2. Biennial Bridge Inspection Report, dated June 3, 2015.
3. Underwater Inspection Report by Hawaii Engineering Group (HEG), dated March 2016.
4. FHWA e-mail by Mr. Domingo Galiciano, P.E. (FWHA), dated August 4, 2016.
5. Draft Preliminary Geotechnical Consultation Letter by Yogi Kwong Engineers (YKE), dated November 15, 2016.

#### **General Description**

1. The Hakalau Stream Bridge is a reinforced concrete arch bridge spanning over Hakalau Stream.
2. The project specifications indicate the bridge was designed and constructed as an arched structure based on prescribed construction sequencing and monitoring while placing concrete for the Arch Ring Abutments and Arch Ring.
3. A recent underwater inspection of the bridge's Arch Ring Abutments discovered severe scouring beneath the full width of the North Arch Ring Abutment (North Abutment) that measured 17 to 25 feet in horizontal depth measured from the face of the Sub-Ledge and vertical opening measuring 5.5 to 8 feet from the stream bed, as identified in the HEG report.

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### Field Visit Observations

#### **General:**

1. The purpose for this field visit was to familiarize ourselves with existing conditions and to identify evidence of structural irregularities.
2. This field visit was conducted on January 13, 2016 around 2:30 p.m. during clear/calm skies and sunshine.
3. The stream flow was below the rock/concrete ledge that was installed at the base of a rockwall that protects the roadway embankment and North Abutment.
4. Rock outcroppings and small boulders were visible above and just beneath the water surface.
5. Views of the bridge superstructure was mostly unobstructed from the West side of the bridge while views of the East side of the bridge were limited due to overgrown vegetation and poor lighting.

#### **Roadway Level:**

1. The roadway asphalt pavement, adjoining rock walls, sign posts, guardrails and concrete bridge railings had no visible signs of structural irregularities.
2. Existing cracks on the concrete bridge railings were patched with an unknown patching material and there were no signs of patch separations or new cracks. In addition, there was no visible joint separation at locations where construction joints might have been installed.

#### **Stream Level:**

1. Access to the North Abutment was gained from an access point located on the West side of the roadway by climbing down a rock embankment to a concrete ledge that continued toward and beneath the North Abutment.
2. Access on the East side of the North Abutment was gained by climbing down a dirt path adjacent to the North Abutment.
3. No attempt was made to access the South Abutment.
4. Evidence of scour was visible on the underside of the concrete ledge running parallel with the roadway and beneath the bridge however no attempt was made to determine the extent of the scour.
5. The visible portions of the arched concrete bridge soffit and abutment did not show signs of structural irregularities such as cracks, fractures or settlement.
6. The silhouetted shape of the Arch Ring Abutment and Arch Ring were visible from the East side of the bridge.

### Field Visit Summary

1. Based on our field visit, we concluded that observable portions of the Hakalau Stream Bridge are constructed in accordance with the design intent presented on the drawings.

2. Other than the cracks observed on the concrete bridge railings we did not observe any structural irregularities including cracks, fractures or differential settlement that would indicate adverse movement or manifestations of structural distress requiring immediate attention.

### **Conclusions and Recommendations**

1. **Structural Opinion:** We believe the arched design and construction of this bridge causes the majority of the foundation's resultant forces to be applied at an angle that is more tangent with the arch and not directly over the scoured cavity. Based on this assumption, it is our professional opinion that the structural integrity of this bridge will remain intact provided the bridge foundation bears upon stable and structurally sound subgrade material. Notwithstanding the risks associated with the scouring beneath the North Abutment, it is WRSA's considered opinion that the subject bridge is capable of supporting a single passenger vehicle not exceeding 6 Tons at any given time. WRSA's opinion that the bridge is safe for limited usage is influenced somewhat by its projected low ADT, lightweight vehicles and YKE's opinion that a significant portion of the foundation loads placed upon the subgrade are beyond the surveyed scoured zone.
2. If adverse physical changes in the bridge are reported in the immediate future or if the COH discovers or acquires new information about this bridge, the COH shall be solely responsible for delivering this information to WRSA for review and appropriate response, including rescinding our Structural Opinion. In any event, we recommend conducting another condition survey within the next 6 months to give WRSA an opportunity to determine whether our Structural Opinion should be revised.
3. To insure public safety, WRSA recommends continued monitoring and frequent inspections of the bridge by qualified and experienced bridge inspectors employed by or hired by the COH. Any changes in the physical condition of the bridge should then be brought to the COH's attention for appropriate action. In addition, WRSA should be notified if movement is observed or suspected. For example, monitoring of the patched cracks on the bridge rails should be check regularly for any signs of movement such as separation of the patching material from the cracked surfaces.
4. WRSA concurs with FWHA's concerns, recommendations and urgency for the COH to take immediate action to reduce or eliminate the risk to the traveling public.

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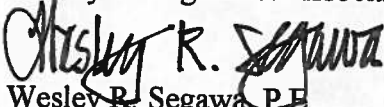
5. WRSA supports YKE's recommendation to conduct site specific in-water reconnaissance and geotechnical investigations as necessary for preparing recommendations to reestablish and protect the subgrade integrity beneath the North Abutment.

#### **Limitations**

1. This report was prepared for the sole use by the COH, Department of Public Works, and the opinions stated in this report are based on limited visual observations on the date of this field visit. No warranty is expressed or implied, no physical testing was performed and no calculations have been made to determine the adequacy of the bridge, its structural system/elements or its compliance with applicable codes and standards of practice.
2. In the event of a claim, as defined by our professional insurance policy, and/or lawsuit filed against WRSA related to the Hakalau Bridge, the COH shall defend, indemnify and hold harmless WRSA, and their officers, employees, and agents from and against all liability, loss, damage, cost, and expense, including attorneys' fees, and all claims, suits, and demands therefore, arising out of or resulting from the acts or omissions of WRSA or WRSA's employees, officers, agents, or subcontractors under the services provided for this Hakalau Stream Bridge project. These provisions shall remain in full force and effect notwithstanding the expiration or early termination of WRSA's services.
3. WRSA reserves the right to revise or change its opinion at any time when new information or data is discovered or revealed and/or physical changes occur in the bridge structure such as cracks, fractures and/or settlement, including rescinding our Structural Opinion.

Thank you for giving us this opportunity to assist and serve the County of Hawaii and its residents. Should there be any questions regarding this report, please feel free to contact the undersigned at (808) 935-4677.

Respectfully submitted,  
Wesley R. Segawa & Associates, Inc.



Wesley R. Segawa, P.E.  
Managing Principal