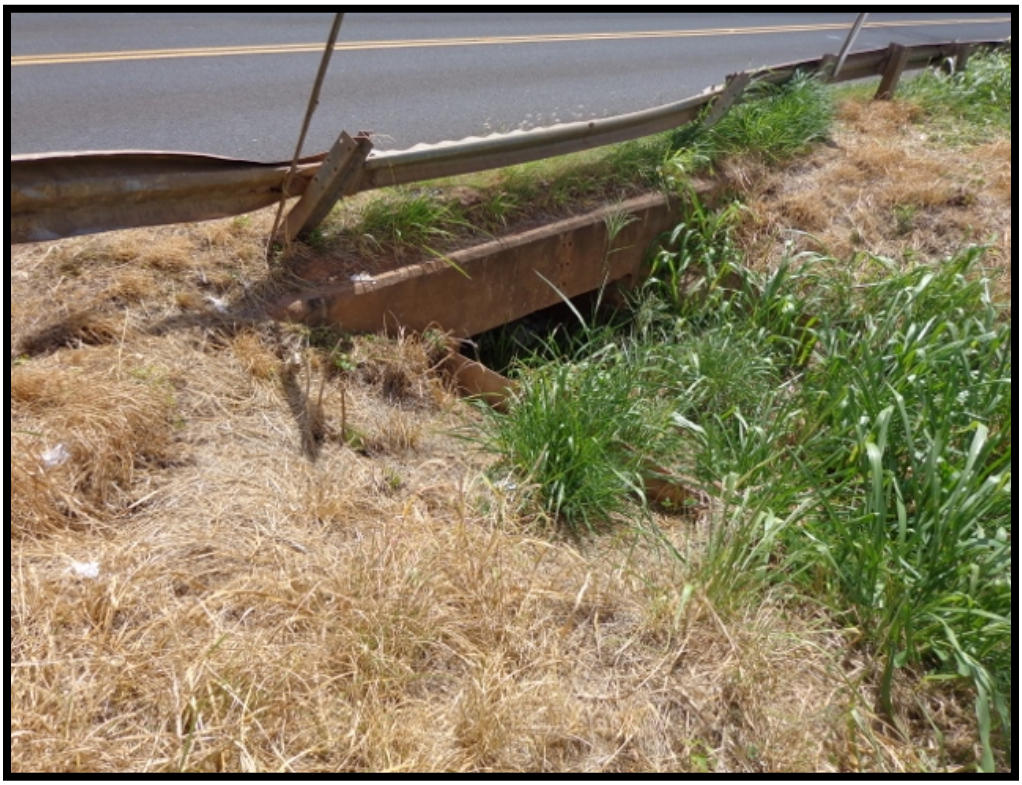
BRIDGE INSPECTION, INVENTORY AND APPRAISAL III, FY 2016

FARRINGTON HIGHWAY BOX CULVERT 1 OVER DITCH BRIDGE NO. 935



Prepared for:

CITY AND COUNTY OF HONOLULU
DEPARTMENT OF DESIGN AND CONSTRUCTION
CONTRACT NO. SC-DDC-1600113

KAI HAWAII
STRUCTURAL & FORENSIC ENGINEERS

50 S. Beretania Street, #C-119C
Honolulu, HI 96813

NOVEMBER 2016

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This work has been prepared by me or under my supervision.

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APPENDICES

SECTION 1.0 - BRIDGE DESCRIPTION

1.1 LOCATION

The culvert is located on Farrington Highway in Kapolei on the island of Oahu.

1.2 DESCRIPTION

The existing structure is a reinforced concrete box culvert.

Year Built: 1922
Tax Map Key (TMK): 9-1-17
Spans: 1
No. of Traffic Lanes: 2
Bridge Rails: W-beam guardrail
Sidewalks: None
Wearing Surface: A.C. wearing surface
Culvert: Reinforced Concrete
Channel: Natural
Utilities: None
Skew: 0°
Clear Span of Bridge: 6'
Roadway Width Curb to Curb: 22'
Total Bridge Width Out to Out: 27'

Global Positioning System (GPS):

	DATUM (NAD83)
Latitude (N)	021° 21' 18"
Longitude (W)	158° 03' 43"

SECTION 2.0 - PREVIOUS INSPECTIONS

2.1 INSPECTION HISTORY

Previous Bridge Inspection Reports and Bridge Appraisal Sheets on file with the City and County of Honolulu are dated: 8/3/1972, 8/4/1975, 7/10/1980, 6/20/1984, 8/8/1988, 4/16/1990, 5/2/1996, 3/2/2004, 11/19/2013.

2.2 LIST OF PREVIOUS SIGNIFICANT OBSERVATIONS

- Upstream guardrail failed
- Heavy vegetation in channels
- 6"-12" of freeboard height at each culvert end

SECTION 3.0 - OBSERVATIONS

3.1 TRAFFIC FEATURES

- Culvert railings do not appear to be crash tested
- The upstream guardrail is in a failed state and has been since before the 1996 inspection of the culvert (see Photo 9)

3.2 DECK

- A.C. wearing surface is in satisfactory condition

3.3 SUPERSTRUCTURE

N/A

3.4 SUBSTRUCTURE

N/A

3.5 CULVERT

- Corroded upstream guardrail posts embedments in upstream headwall (see Photo 14)
- Spall measuring 8" high x 16" wide x 1" deep occurring at the top East corner of the upstream headwall (see Photo 15)
- 12" long x 72" wide area of delamination occurring in culvert soffit at inlet (see Photo 17)
- Spall measuring 10' long x 30" wide x 2" deep with 8 exposed reinforcing bars occurring in culvert soffit near outlet above the East culvert wall (see Photo 18)
- Spall measuring 10' long x 24" wide x 2" deep with 8 exposed reinforcing bars occurring in culvert soffit near outlet above the West culvert wall (see Photo 19)
- Scaling occurring along the top 12" of the culvert walls (see Photo 22)
- Scattered spalls occurring throughout downstream headwall (see Photo 25)

3.6 STREAM OVERVIEW

- Concrete block built at outlet leaves only the top 16" of the culvert for water to flow through (see Photo 26)

3.7 COMPARISON WITH PREVIOUS INSPECTION

The culvert appears to have been recently cleaned so inspection inside the culvert was possible. Extensive spalling was discovered during this inspection in the culvert soffit with many exposed reinforcing bars,

SECTION 4.0 - LOAD RATINGS

4.1 LOAD RATINGS

This structure is not posted for reduced load carrying capacity. The visual inspection of the structure found no evidence of overload or over stress. Load rating calculations were completed for this structure. The load rating summary can be found on the next page. The calculations are located in Appendix E.

City and County of Honolulu
Bridge Load Rating Summary

Existing Bridge Data

Bridge Number:	935	Last Load Rating Date:	11/23/2016
Bridge Name:	Farrington Hwy Box Culv No. 1	Last Inspection Date:	10/6/2016
Structure Number:		Inspected By:	KAI Hawaii
District:		Fracture Critical Members (Y/N):	N
Span Type:	Reinforced Concrete Box Culvert	Item 58, Deck Rating:	N
Bridge Plans Available (Y/N):	Y	Item 59, Superstructure Rating:	N
Design Loading:		Item 60, Substructure Rating:	N
Past Inventory Rating:		Bridge Load Posted (Y/N):	N
Past Operating Rating:		Posted Weight Limit:	N/A

Bridge Load Rating Summary

Dead Load Data

Overlay Type:	Asphalt
Overlay Depth (IN):	3
Was Overlay Depth Measured (Y/N):	N
Weight of Utilities:	N/A
Weight of other Non-Structural Attachments:	N/A

LRFR Evaluation Factors:

Surface Roughness Rating:	2
Condition Factor:	1.00
System Factor:	1.00
ADTT (one way):	Unknown

Superstructure/Deck Rating Summary

	Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
Design Load	HL-93 (INV)	N/A	0.86	Middle of top slab, inside face	Flexure	33.0%	0.138
	HL-93 (OPR)	N/A	1.11	Middle of top slab, inside face	Flexure	33.0%	0.138
Legal Load	Type 3	50.0	1.42	Middle of top slab, inside face	Flexure	33.0%	0.138
	Type 3S2	72.0	1.56	Middle of top slab, inside face	Flexure	33.0%	0.138
	Type 3-3	80.0	1.51	Middle of top slab, inside face	Flexure	33.0%	0.138
	NRL	80.0	1.42	Middle of top slab, inside face	Flexure	33.0%	0.138
	SU4	54.0	1.42	Middle of top slab, inside face	Flexure	33.0%	0.138
	SU5	62.0	1.42	Middle of top slab, inside face	Flexure	33.0%	0.138
	SU6	69.5	1.42	Middle of top slab, inside face	Flexure	33.0%	0.138
	SU7	77.5	1.42	Middle of top slab, inside face	Flexure	33.0%	0.138
Permit Load	HP1	120.0	1	Middle of top slab, inside face	Flexure	33.0%	0.138
	HP2	157.0	0.6	Middle of top slab, inside face	Flexure	33.0%	0.138
	HP3	209.9	1.19	Middle of top slab, inside face	Flexure	33.0%	0.138

Substructure Rating Summary

Substructure Rated (Y/N): -

Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
HL-93 (INV)	N/A	-	-	-	-	-
HL-93 (OPR)	N/A	-	-	-	-	-
Legal Load	N/R	-	-	-	-	-
Permit Load	N/R	-	-	-	-	-

Posting Analysis Summary

Governing Rating Factor:	1.42
Governing Load Model:	Type 3
Posting Recommended (Y/N):	N
Recommended Posting Load:	-

Please check the following boxes that apply:

- [x] Bridge load rating is not governed by deck rating
- [x] Bridge load rating is not governed by substructure rating
- [x] Connections do not control the bridge load rating
- [ ] Exterior girder controls the bridge load rating
- [ ] Bridge plans do not exist - Rated based on judgement and current loading

Quality Control/Quality Assurance

Load Rating Engineer Name:	Saeid Pourjalali
Load Rating Engineer License No.:	11475
Load Rating Engineer Signature:	
Load Ratings Checked By:	Bryan Lum
Quality Assurance By:	Mike Hunnemann
Load Rating Date:	11/23/2016

Remarks/Recommendations for Bridges without Plans

City and County of Honolulu
Bridge Load Rating Summary

Existing Bridge Data

Bridge Number:	935	Last Load Rating Date:	11/23/2016
Bridge Name:	Farrington Hwy Box Culv No. 1	Last Inspection Date:	10/6/2016
Structure Number:		Inspected By:	KAI Hawaii
District:		Fracture Critical Members (Y/N):	N
Span Type:	Reinforced Concrete Box Culvert	Item 58, Deck Rating:	N
Bridge Plans Available (Y/N):	Y	Item 59, Superstructure Rating:	N
Design Loading:		Item 60, Substructure Rating:	N
Past Inventory Rating:		Bridge Load Posted (Y/N):	N
Past Operating Rating:		Posted Weight Limit:	N/A

Bridge Load Rating Summary

Dead Load Data

Overlay Type:	Asphalt
Overlay Depth (IN):	3
Was Overlay Depth Measured (Y/N):	N
Weight of Utilities:	N/A
Weight of other Non-Structural Attachments:	N/A

LRFR Evaluation Factors:

Surface Roughness Rating:	2
Condition Factor:	1.00
System Factor:	1.00
ADTT (one way):	Unknown

Superstructure/Deck Rating Summary

Vehicle Type		Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
Refuse Vehicles	REF1	51.00	1.29	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	REF2	57.18	1.21	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	REF3	45.94	1.42	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	REF4	57.50	1.23	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
Buses	BUS1	30.99	1.18	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS2	39.60	0.96	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS3	39.60	0.96	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS4	64.38	0.95	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS5	67.24	0.84	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS6	67.78	0.87	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS7	66.79	0.86	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS8	39.90	0.89	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS9	39.60	0.96	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS10	39.60	0.96	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	BUS11	42.54	0.86	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
Honolulu Fire Department Trucks	HFD1	38.40	1.00	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD2	42.74	1.00	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD3	43.50	1.00	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD4	49.80	0.89	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD5	49.80	0.89	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD6	49.80	0.89	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD7	52.20	0.76	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD8	62.74	1.09	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD9	73.50	0.92	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD10	59.24	1.00	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD11	60.00	1.20	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD12	51.18	1.27	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD13	58.00	1.20	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD14	44.00	0.79	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD15	44.00	0.80	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD16	44.00	0.99	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD17	42.74	1.00	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD18	76.60	0.77	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD19A	77.56	0.90	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD19B	77.56	0.92	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD20A	87.56	0.90	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD20B	87.56	0.92	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD21	42.00	1.00	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138
	HFD22	37.00	1.05	Middle Of Top Slab, Inside face	Flexure	33.0%	0.138

Substructure Rating Summary

Substructure Rated (Y/N):	-

Recommended Refuse Vehicle

Recommended Refuse LR Factor:	1.21
Recommended Refuse Load Model:	ALL
Recommended Max Payload:	FULL

*Payload is Allowable Vehicle Load Caryying Capacity

Please check the following boxes that apply:

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Quality Control/Quality Assurance

Load Rating Engineer Name:	Saeid Pourjalali
Load Rating Engineer License No.:	11475
Load Rating Engineer Signature:	
Load Ratings Checked By:	Bryan Lum
Quality Assurance By:	Mike Hunnemann
Load Rating Date:	2/28/2017

Remarks/Recommendations for Bridges without Plans

SECTION 5.0 - GENERAL CONDITION ASSESSMENT

5.1 CONDITION ASSESSMENT

In general, the culvert is in poor condition.

5.2 MAINTENANCE RECOMMENDATIONS

MAINTENANCE RECOMMENDATIONS
No maintenance recommendations at this time.

5.3 REPAIR RECOMMENDATIONS

In consideration of the limited resources available for bridge rehabilitation, the City should prioritize the remediation of the deficiencies as it deems to be appropriate.

REPAIR RECOMMENDATIONS	ESTIMATED COST
Upgrade bridge railings	$10000.00
Repair spalls in culvert headwalls and soffit	$30000.00