

SECTION 653 – CONCRETE CULVERT LINING

653.01 Description. This section describes repairing damaged culvert surface; grouting voids beneath existing culvert invert; and constructing reinforced concrete lining.

653.02 Materials.

(A) Portland Cement Concrete. Concrete for concrete culvert lining shall have a minimum 28-day strength, f_c of 4,000 psi and shall conform to the requirements of Section 601 - Structural Concrete. The Contractor shall proportion the concrete lining mix to provide a workable mix of uniform composition and consistency. Use coarse aggregate no. 67 (3/4 inch to No. 4). The total free water shall not exceed 285 pounds per cubic yard of concrete and the water cement ratio shall not exceed 0.45. The slump of concrete shall be 3 to 5 inches. Use water-reducing, water-reducing and retarding, or high range water reducing admixtures as needed to achieve the desired slump and workability. No water shall be added at the jobsite.

B) Other Materials. Other materials shall conform to the following:

Portland Cement	701.01
Fine Aggregate for Concrete	703.01
Water	712.01
Angle Iron	713.01
Welded Wire Fabric Reinforcement	709.01 (C)
Emulsified Asphalt Coating	ASTM D 1227 Type IV
Epoxy	ASTM C881, Type II or V, Grade 2, Class C

653.03 Construction Requirements. Work shall be done in increments of 50 linear feet or less.

Consult with a Geotechnical Engineer, licensed to practice in the State of Hawaii, to determine the bracing required and ensure stability of the culvert. Install the increment's bracing prior to commencing culvert cleaning within the increment. The bracing shall remain in place for not less than 72 hours after the concrete lining has been poured.

Remove and dispose of dirt, rust, scale, and other loose materials from interior of culvert. Cut, remove, and dispose of corroded sections as ordered by the Engineer.

653.03

48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94

Weld 3/16-inch thick, 2-inches in height by 2-inches in width by 1-foot long angle irons to the crest of the corrugations of the culvert at two-feet on-center, longitudinally.

Place the welded wire fabric steel reinforcement, two-inches above the crest of the corrugations by laying on the angle irons. Lap welded wire fabric a minimum of six-inches.

Prior to installing angle irons and welded wire fabric, the Engineer will inspect and accept the prepared culvert surface.

Apply epoxy-bonding agent after cleaning metal surface, just before concrete placement. Clean culvert surface 12 inches above limits of epoxy bonding agent by hydrowashing with minimum water pressure of 5,000 pounds per square inch. Remove excess bonding agent that collects in the pockets. Epoxy bonding agent shall be tacky when concrete is placed.

Repair damage to welded wire fabric and angle irons that occur during concrete placement at no increase in contract price and contract time. Trowel concrete to form a smooth, dense surface finish. Fill voids beneath culvert invert with concrete. Score concrete culvert lining 1/8-inch wide, 1-inch deep laterally, at 10 feet on-center. If the Contractor chooses to score by sawcutting, sawcut between four to eight hours after concrete is placed.

Cure concrete in accordance with Subsection 503.03 (L) - Curing Methods. Allow concrete placed in the culvert to cure for a minimum of 48 hours before allowing water to flow through culvert.

After concrete has cured and has been scored laterally, apply two coats of emulsified asphalt to both edges of lining and to the 3/4-inch scores. Clean metal and concrete surfaces to be coated. Asphalt coating at edge of lining shall be 6-inches wide along length of culvert lining. Finished coating shall be a continuous film, free of voids, gaps, or pin holes.

653.04 Method of Measurement.

- (1) Concrete culvert lining will be paid on a lump sum basis. Measurement for payment will not apply.
- (2) The Engineer will measure removal of damaged culvert sections per square yard in accordance with the contract documents.
- (3) The Engineer will measure concrete placed beneath culvert invert per cubic yard in accordance with the contract documents.

95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130

653.05 Basis of Payment. The Engineer will pay for the accepted pay items listed below at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for each of the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Concrete Culvert Lining for _____ - Inch Culvert	Lump Sum
Removal of Damaged Culvert Sections	Square Yard

The Engineer will pay for:

(1) 80 percent of the contract bid price upon completion of removing the damaged culvert sections

(2) 20 percent of the contract bid price upon completion of disposing the damaged culvert sections.

Concrete Placed Beneath Culvert Invert	Cubic Yard
--	------------

The Engineer will pay for:

(1) 80 percent of the contract bid price upon completion of placing the concrete.

(2) 20 percent of the contract bid price when tests of the material are found acceptable.

END OF SECTION 653