#### IOWA DEPARTMENT OF TRANSPORTATION

**TO OFFICE:** District 5 **DATE:** October 9<sup>th</sup>, 2020

**ATTENTION:** James V. Armstrong **PROJECT:** Washington County

NHSN-001-4(59)--2R-92

**FROM:** Anthony J. Klein PIN: 21-92-001-010

**OFFICE:** District 5 Design

**SUBJECT:** FY 2022 – RCB Culvert - Replacement Project Concept

**PROJECT LOCATION MAP:** Page 5 or Click Here

BACKGROUND: Washington County, IA 1 - MM 43.31 - 5'x5' RCB

Maintenance noticed a sink hole above the box in the aggregate shoulder which indicated a possible void near the box. Upon further investigation a void was found under the upstream drop inlet headwall. Maintenance filled this void with low strength flowable fill, temporarily bypassed a 12" tile line through the culvert and used the remainder of the flowable on the floor of the culvert to shore up the cracks.

The as-built plans from the 1940's they show a 6" tile line that was ran into the inlet area of this culvert from the northwesterly direction. Sometime between then and now a 12" line was stubbed directly into the drop portion of the inlet side of the culvert as shown in the photo below. There is undermining of the floor of this culvert from an unknown water source. This was noticed from the suck hole in the aggregate shoulder near the top of the culvert as mentioned above. As noted above, the district bridge repair crew bypassed the 12" tile line through the culvert to see if that would alleviate the water running under the floor. It slowed down the flow but there was still water flowing from an unknown source.

If nothing is done at this location more undermining can occur causing section loss under the roadway and around the culvert and the pavement could collapse near the culvert.

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# PHOTOS:



Holes in the floor of the box.



Crack across the entire floor near the downstream end. Water also running under the concrete floor.



Inlet end of the culvert



Crack across entire floor near outlet end

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### **FEASIBLE OPTIONS**:

The culvert should be replaced based upon the structural condition of the box, particularly the floor. This RCB was analyzed for slip lining and did not meet the criteria.

It is recommended that a single 88 inch x 54 inch low clearance RCP as the replacement for this culvert. The culvert can be replaced using the existing flow lines and adequate cover will be provided over the top of the pipe.

There are three options on how to accomplish this work for the replacement. One is to jack a new pipe next to the existing RCB a second is by detouring traffic and the third option is via stage construction. With the detour option the out-of-distance travel route is approximately 46 miles, this is primarily state roads and using some county roadways.

A 30' clear zone was used to compute total length of pipe needed using the existing flowline elevations. A partially grouted revetment splash basin is recommended at the outlet for erosion control due to high velocities.

Option 1: Pipe Jacking

Abandon-in-Place, Existing Culvert 5'x5' RCB		1250	CF	\$ 24	\$30,000
Excavation, Class 10		350	CY	\$ 25	\$8,750
Embankment In-Place		200	CY	\$ 31	\$6,200
CULV, CONC PIPE, 2000D, TRENCHLESS, 72"		84	LF	\$ 1,600	\$134,400
APRON, CONC, 72"		2	EA	\$ 3,500	\$7,000
Class B Revetment		85	CY	\$ 70	\$5,950
Class E Revetment		75	CY	\$ 60	\$4,500
Grout for partially grouted revetment		6	CY	\$ 250	\$1,500
	Con	tigency (10%)			\$19,830
	Mobi	lization (20%)			\$39,660
	Traffic	Control (5%)			\$9,915
	Total =				\$267,705

Estimate: \$268,000

Option 2: Detour

Option 2. Detour					
Embankment-In-Place	178	CY	\$	25	\$4,450
Removal, Existing Culvert 5'x5' RCB	50	LF	\$	100	\$5,000
88 inch x 54 inch low clearance pipe, 97 LF	97	LF	\$	600	\$58,200
88 inch x 54 inch low clearance pipe aprons, 2 EA	2	EA	\$	3,500	\$7,000
Modified Subbase	534	CY	\$	68	\$36,312
Pavement	30	CY	\$	165	\$4,950
Class B Revetment	85	CY	\$	70	\$5,950
Class E Revetment	75	CY	\$	60	\$4,500
Grout for partially grouted revetment	6	CY	\$	250	\$1,500
Out of Distance Cost (10 WD) - 46 mi total; 34.4 mi on state & 11.6 mi on county	1	LS	\$	244,754	\$244,754
Con	tigency (10%)				\$36,817
Mobilization (10%)				\$36,817	
Traffic Control (10%)			\$36,817		
Total =					\$478,616

Estimate: \$235,000

Out of Distance travel cost: \$245,000

Total Cost: \$480,000

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Option 3: Stage Construction

SPECIAL BACKFILL	CY	250	\$37.00	\$9,250.00
EMBANKMENT-IN-PLACE	CY	698	-	\$14,658.00
EXCAVATION, CL 13, WASTE	CY	625	\$20.00	
SHLD CONSTRUCTION, EARTH	STA	11.2	\$480.00	\$5,376.00
DETOUR PAV'T	SY	1,125.00	\$76.00	\$85,500.00
RMVL OF EXIST STRUCT	LS	1	\$5,000.00	\$5,000.00
FLOODED BACKFILL	CY	322	\$49.00	\$15,778.00
EXCAVATION, CL 20, RDWY PIPE CULV	CY	165	\$21.00	\$3,465.00
APRON, LOW CLEARANCE CONC, EQUIV DIA 72"	EA	2	\$3,500.00	\$7,000.00
CULV,LOW CLEAR CONC RDWY PIPE,EQ DIA 72"	LF	98	\$600.00	\$58,800.00
CONC GROUT-REVETMENT+GABION	CY	6	\$250.00	\$1,500.00
REVETMENT, CL B	TON	85	\$70.00	\$5,950.00
REVETMENT, CLASS E	TON	75	\$60.00	\$4,500.00
TEMP BARRIER RAIL, CONC	LF	375	\$15.00	\$5,625.00
TEMP TRAFFIC SIGNAL	EA	2	\$11,000.00	\$22,000.00
PATCH, FULL-DEPTH FINISH, BY AREA	SY	66.7	\$176.00	\$11,739.20
PATCH, FULL-DEPTH FINISH, BY COUNT	EA	2	\$700.00	\$1,400.00
SUBBASE, (PATCH)	SY	66.7	\$22.00	\$1,467.40
TEMP CRASH CUSHION, SEVERE USE (SU)	EA	4	\$5,800.00	\$23,200.00
TRAFFIC CONTROL 5.00 %	LS	1	\$14,735.43	\$14,735.43
MOBILIZATION LS 5.00 %	LS	1	\$14,735.43	\$14,735.43
PCT-999 UNQUANTIFIED % of Project 30.00 %				\$97,253.84
			Total =	\$421,433.30

Estimate: \$220,000 Staging Items: \$200,000 Total Cost: \$420,000

### **RECOMMEMDATIONS:**

Option 1: Pipe Jacking is preferred based on costs and other factors with construction and detours. Tile exploration should be performed with this project to make sure there isn't any other tiles coming through this area that need to be addressed.

Estimate: \$268,000

ROW will be needed for this project.

NOTE: Right of way and\or easement costs are not included in the above cost estimate.

#### **FUNDS PROGRAMMED**:

It has been identified by the District 5 office for construction in FY 2022. A schedule of events for plan development will be determined following approval of the Project Concept.

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## **LOCATION MAP**:



cc:

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B. Lauderman	J. R. Phillips
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