

U.S. Department of Transportation Federal Highway Administration- California Division- Title 23 Damage Assessment Form (DAF)		DAF No. <input type="text"/> - NAP <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/>
Applicant Napa County Public Works		County Napa Congressional districts 5
Location of Damage: Name of Road/Bridge: <u>OLD SONOMA ROAD CULVERT</u>		Incident Date (mm/dd/yyyy) <u>08/24/2014</u> Inspection <u>09/24/2014</u>
Per Site <input checked="" type="checkbox"/> or <input type="checkbox"/> Per Mile		Federal-aid Highway? Y for yes, if no, ineligible for ER funds <input type="checkbox"/> Y
PM Begin: <u>2.27</u> PM Length: <u>39.00</u> PM End: <u>2.27</u> (in feet)		Map No <u>5K12</u>
Road/Bridge Data: Bridge No. <u>        </u> Type: <u>        </u>		Functional Classification Type: MAJOR COLLECTOR
Traveled Way: Width <u>24</u> Type: PCC <input type="checkbox"/> AC <input checked="" type="checkbox"/> Gravel <input type="checkbox"/>		Route # <u>        </u>
Shoulder: Width <u>8</u> Type: PCC <input type="checkbox"/> AC <input checked="" type="checkbox"/> Gravel <input type="checkbox"/>		Forest Hwy? Y/N <input type="checkbox"/> N Interstate? Y/N <input type="checkbox"/> N
Description of Damage: Extensive cracks (1" wide) in the stone arch culvert and cracks in pavement due to 2014 South Napa earthquake event (Magnitude 6.0).		Existing ADT: <u>2,586</u>

COST ESTIMATE			
Emergency Opening (EO)	Type of Repair	Description of Work	Cost Summary
	EO- AGENCY FORCES CT Work Order #(s): <u>        </u> EA(s): <u>        </u>		
EO- CONTRACT EO EA(s): <u>        </u>			PE <u>        </u> CE <u>        </u> Construction <u>        </u>
<b>NOTE: Environmental documentation for EO is required. It is generally started after work has begun.</b>			R/W <u>        </u>
<b>Subtotal Emergency Opening</b>			<b>\$0</b>
Permanent Restoration (PR)	PR- CONSTRUCTION FA requires an approved PIF <input checked="" type="checkbox"/> Contract <input type="checkbox"/> FA PR EAs <u>        </u>	Repair stone arch culvert with concrete shell around arch.	PE <u>53,594</u> CE <u>80,392</u> Construction <u>669,931</u>
	<b>NOTE: PRIOR AUTHORIZATION (APPROVED E-76) IS REQUIRED TO PROCEED WITH PERMANENT RESTORATION R/W &amp; CONSTRUCTION</b>		
	<b>NOTE: Environmental clearance for permanent restoration is conducted through normal Federal-aid procedures</b>		
<b>Subtotal Permanent Restoration</b>			<b>\$803,917</b>
Eligible	Signature	Date	PE Total <u>\$53,594</u>
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Local Agency (if applicable): <u>Mallika Ramachandran</u>	<u>4-13-2015</u>	CE Total <u>\$80,392</u>
<input type="checkbox"/> Yes <input type="checkbox"/> No	Caltrans: <u>[Signature]</u>	<u>5-8-15</u>	R/W Total <u>\$0</u>
<input type="checkbox"/> Yes <input type="checkbox"/> No	FHWA*: <u>[Signature]</u>		Construction Total <u>\$669,931</u>
<b>TOTAL ESTIMATE</b>			<b>\$803,917</b>

Agency sig. Name (print): Mallika Ramachandran FHWA Sig. Name (print):           
 CT signature Name (print): John Brauser DAF Prepared by (print): Yoliana Swenson, P.E. BCA

Original: Caltrans District Copies: FHWA, Division of Local Assistance(local roads), Federal Resources (state hwy), HQ Major Damage Engineer (state hwy)  
 \*Write "N/A" in FHWA signature block if the project has no Federal ER funding or Federal ER funding delegated to the State.  
 FHWA Signature: REQUIRED for all Federal Funded State projects. REQUIRED for any Local Agency projects with 1) any BETTERMENT, 2) more than 2 ROW takes or 3) when paving is more than 50% of the Total Estimated Cost. Reminder: This DAF must be accompanied by photos of the damage.



Justifications/comments

Stone arch culvert repair will include adding new concrete shell around arch barrel. The new concrete shell will have concrete reinforcing. New concrete shell will be connected to existing stone arch barrel with drill & bond dowel. Existing cracks at stone arch barrel will be pressure grouted.

Item #16 of Environmental Process, Permitting & Fees, Environmental Mitigation, Environmental Monitoring & Reporting will include:

- Environmental Process – CEQA/NEPA Process required coordination with the following agencies: CDFWL, ACOE, RWQCB, NOAA, USFWL, FEMA, SHPO, etc.
- Permitting & Fees - For permits from RWQCB and CDFWL, on an average is approximately \$2,000 each, plus another approximately \$2,000 for CDFWL to review Initial Study/MND (if one is required).
- Environmental Mitigation – depending on the complexity of the project and impact ranges from riparian restoration at a 3:1 ratio to habitat structures and fish passage and scour measures.
- Environmental Monitoring and Reporting: Includes construction phase monitoring and post construction monitoring which is a minimum 5 years of maintenance, monitoring and reporting.

25% of contingency is used for unforeseen expenses or unknown factors encountered during construction, which are typical with this repair type of project.

Photos, Sketches, and/or Narrative



**Pavement cracks above culvert**



**Culvert Inlet**



**Cracks in stone arch bridge**



**Cracks in stone arch bridge**



**Damage Assessment and Recommendations Report**  
**Old Sonoma Road MPM 2.27 Culvert**  
**03/17/15**

**Damage Assessment**

Old Sonoma Road culvert at MPM 2.27 consists of stone masonry arch and 60" diameter reinforced concrete pipe. The existing stone masonry arch portion is approximately 25' long.

Unreinforced mortared stone masonry construction is very susceptible to lateral seismic loads and displacements. Post-earthquake the structure experienced cracks in the mortar reducing bond capacity. Without tension reinforcement, lateral loading or displacements reduces the design compression within the arch element and when sufficiently large, would impose tension between the stones. With negligible tension capacity provided by the mortar bond, the mortared joints will crack and de-bond from the stones. Once the stones are de-bonded, continued seismic loading and displacements or gravity will loosen the de-bonded stones and the stones will fall from the arch. Because the masonry arch is a compression structure, missing stones reduces the vertical load capacity of the arch and weakens the arch. If sufficient stones fall from the arch, the arch culvert is susceptible to collapse under vehicular loading. In this bridge, we observed severe cracks. Extensive cracks along the entire perimeter of the existing stone masonry arch at various locations were observed. The cracks vary in width up to 1" wide.

Cracks at the asphalt roadway surface above the culvert were also observed.

**Recommendations**

The repair option will consist of strengthening the stone arch portion with a reinforced concrete shell over the outside of the stone arch segment. Strengthening will need to be performed by replacing any missing stones and pressure grouting the cracks in the mortar between the stones, excavating around the stone arch segment to access the stone arch from the outside, drilling and bonding dowels into the back of the stones, placing a reinforced concrete shell around the outside perimeter of the stone arch culvert and tying the two structures together with the dowels. The reinforced concrete pipe culvert portion will be left as is since there is no damage to the concrete pipe portion. However the existing concrete culvert/barrel may not meet current hydraulic requirements, including fish passage/velocity requirements of regulatory agencies.

Temporary shoring will be required during excavation and installation of concrete shell to maintain traffic during construction. Dewatering the stream and environmental approval will also be required during repair, as repair will have to be done from within the stream top of banks.

Current applicable design standards consist of AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS with CALIFORNIA Amendments, CALTRANS SEISMIC DESIGN CRITERIA, and NAPA COUNTY ROAD & STREET STANDARDS and other codes, standards, laws and regulations governing the seismic design, roadway design, and environmental clearance process and construction safety.

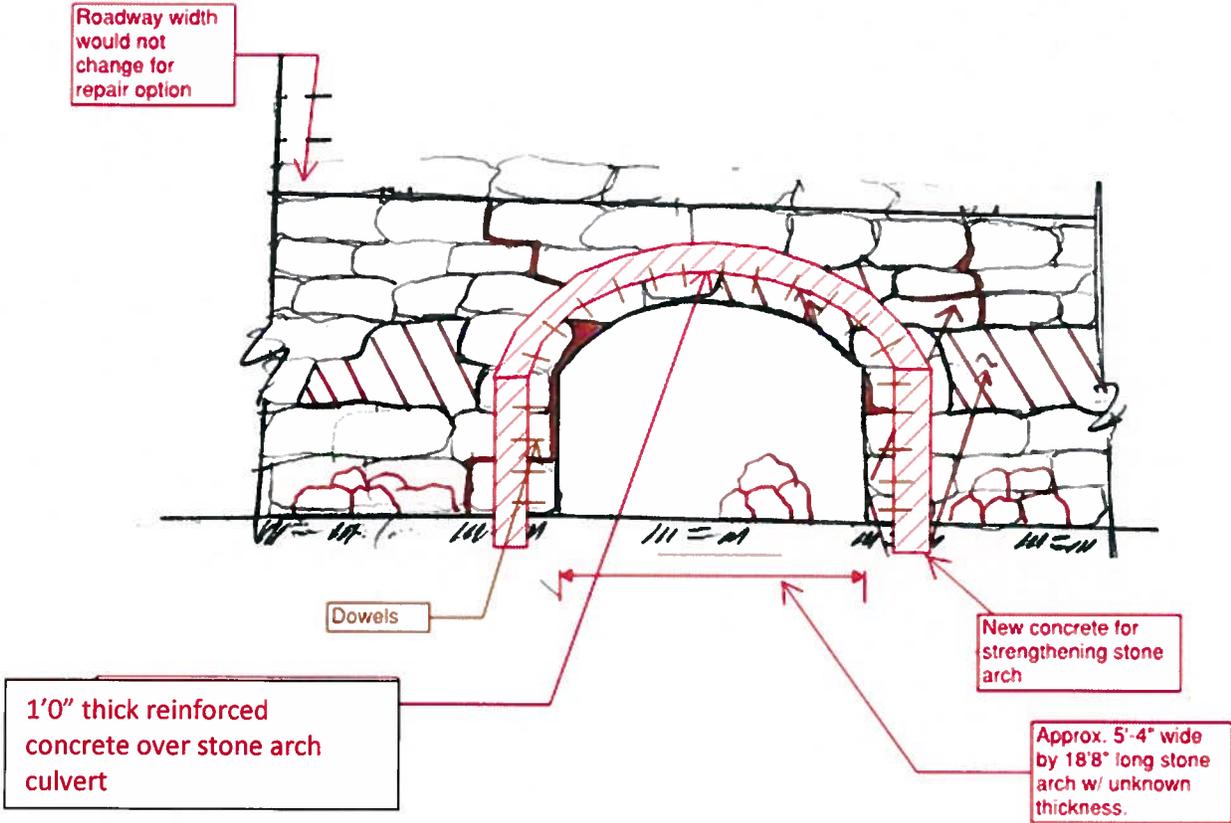
Please note that the repair solution and cost estimate is based on the assumption that the existing structure meets all current codes, standards and regulations, which are highly unlikely. In the

preliminary engineering phase hydraulics, geotechnical, unforeseen site conditions, archeology/historic significance, and other studies, and State and Federal permitting regulations and requirements may show that the proposed repair solution do not meet current code, standards and regulations and the existing bridge repair strategy will have to be modified to meet current codes, standards and regulations leading to higher repair.

PREPARED BY: YOLIANA SWENSON, P.E  
BKF/Biggs Cardosa Associates, Inc.

REVIEWED BY: MALLIKA RAMACHANDRAN, P.E., SUPERVISING CIVIL ENGINEER  
COUNTY OF NAPA

**SKETCHES:**



**ELEVATION AT STONE ARCH**  
**NOT TO SCALE**

## INITIAL SUMMARY REPORT OF STRUCTURE

<b>LOCATION</b>		
County <u>Napa County</u> Division <u>Public Works</u> District <u>1</u> / Item # <u>66</u>		
On Route <u>Old Sonoma Rd</u> at Milepost <u>2.27</u> or Miles From _____		
<b>TYPE OF CULVERT</b>	<b>BARRELS</b>	<b>Date of Inspection</b>
Shape <u>Circular</u>	Size <u>60" dia. &amp; 82" stone arch</u>	<u>9/25/14</u>
Material <u>Stone &amp; RCP</u>	Number <u>1</u>	
Coating <u>N/A</u>		
<b>CONDITION</b>		
Channel & Channel Protection Channel Scour Embankment Erosion Drift Silt Vegetation	<u>Remarks</u>	
Culvert & Retaining Walls Barrel Headwall Wingwall Settlement Adequacy of Cover	<u>Remarks</u>	
	Extensive cracking in the stone arch portion	
	No Damage Observed	
	No Damage Observed	
	No Damage Observed	
	N/A	
Roadway Shoulders Embankment Pavement	<u>Remarks</u>	
	N/A	
	No Damage Observed	
	Some cracks in pavement	
<b>Recommendations and Miscellaneous Comments</b>		
Cracks in the pavement above the culvert are observed. Existing stone arch portion is about 25' long and has extensive cracking (1" wide) along the entire perimeter of the arch at various locations.		

**Initial Summary of Findings:**

- Severe cracks between stones on stone masonry arch.
- Cracks at roadway surface above culvert

These initial findings are based only on visual observations of existing conditions at the time of the damage assessment. Certain conditions may not be visible or may be affected by the passage of time.

