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To: Stefan Galvez, California Department of Transportation
From: JAMES REYFF
CC: Ivy Edmonds-Hess, Parsons Brinckerhoff
Courtney Cacace, Garcia and Associates
Date: October 27, 2009
Re: San Francisco-Oakland Bay Bridge East Span Seismic Safety Project, Self-Anchored Suspension Span
Subject: T1 Temporary Access Trestle Installation – Hydroacoustic Measurements For October 26, 2009

The California Department of Transportation (Department) is in the process of replacing the existing East Span of the San Francisco-Oakland Bay Bridge (SFOBB) with a new bridge immediately to the north. To facilitate the construction of the Self-Anchored Suspension Span portion of the new East Span, twenty 36-inch diameter steel pipe piles will be installed to support a temporary access trestle (see Figure 1). Hydroacoustic data was collected during impact pile driving of three piles with the bubble curtain in operation. The piles were identified from Figure 1 as piles number 18, 19 and 20. Underwater sound measurements were collected at positions 10 meters (35 feet), 24 to 28 meters (79 to 92 feet), and about 1,000 meters (3,050 feet) from the pile, at a depth of 2 to 3 meters (6 to 9 feet) on October 26, 2009 during impact driving. The impact driving was conducted using the Delmag 30-32 diesel impact hammer. There were approximately 144 pile strikes, 141 piles strikes and 168 pile strikes during the driving of piles number 18, 19 and 20, respectively. The peak criteria of 206 dB re: 1 μ Pa at 10 meters (25 feet) from the pile was exceeded for all three pile driving events. The accumulated SEL criterion of 187 dB re 1 μ Pa-sec² at 28 meters (92 feet) from the pile was exceeded for all three pile driving events. Note that the 28-meter (92-foot) position moved from pile to pile, therefore, it is not possible to measure the daily accumulated SEL at any one position. Each pile was about 5 meters (16 feet) from the other. The measurement results for the close-in measurements including accumulated SEL are summarized Table 1. Root-Mean-Square (RMS) sound levels are summarized in Table 2 below.

Note that the contractor began driving the third pile earlier than scheduled, which was before the hydroacoustic monitoring team was fully in position. As a result, the first 55 seconds (19%) of pile driving for the third pile was missed at the 24-meter (79-foot) position. The monitoring location was set at 24 meters (79 feet) from the pile rather than 28 meters (92 feet) to avoid missing the entire event at this position. The difference in levels between 24 and 28 meters (79 and 92 feet) is probably 1 dB, in theory. The 10-meter (35-foot) position captured the full pile driving event. The boat used to measure the RMS level at 1,000 meters (3,280 feet) was not available for the third pile because it was used to assist the bird predation monitoring boat that had engine problems.

The strong current created noise on the hydrophone at the approximate 1,000-meter (3,280-foot) position, so the RMS data reported in Table 2 will have to be confirmed through subsequent analysis.

Table 1: Summary of Measured Sound Levels for October 26, 2009

Pile	Time	Location	Peak		SEL		
			Maximum	Range	Typical Single Strike	Range	Accumulated SEL
1	1001 to 1005	10 meters	207 dB	199 to 207 dB	177 dB	172 to 178 dB	198 dB
	(238 sec)	28 meters	202 dB	196 to 202 dB	173 dB	171 to 175 dB	195 dB
2	1145 to 1149	10 meters	208 dB	205 to 208 dB	180 dB	179 to 181 dB	201 dB
	(205 sec)	28 meters	205 dB	198 to 202 dB	174 dB	172 to 174 dB	195 dB
3	1341 to 1346	10 meters	207 dB	200 to 207 dB	175 dB	173 to 177 dB	198 dB
	(284 sec)	24 meters	205 dB	202 to 205 dB	176 dB	174 to 177 dB	198 dB

Table 2: Summary of Measured RMS Sound Levels for October 26, 2009

Pile	Time	Location	RMS	
			dB re: 1µPa	
			Mean	Range
1	1001 to 1005	28 meters	186	183-189
		~1,000 meters	155*	152-155*
2	1145 to 1149	28 meters	187	186-188
		~1,000 meters	158*	155-160*
3	1341 to 1346	24 meters	189	186-191
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* Data affected by low-frequency background or current effects and will need to be validated through subsequent analysis

** Sampling was not conducted due to boat issues

Figure 1

