

State of California Department of Transportation



**San Francisco – Oakland Bay Bridge
East Span Seismic Safety Project**

**MARINE MAMMAL MONITORING FOR THE SELF-
ANCHORED SUSPENSION SPAN TEMPORARY
TOWERS**

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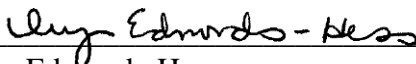


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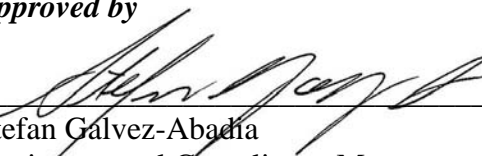
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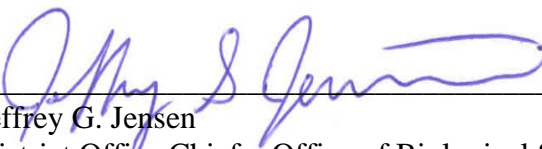


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EXECUTIVE SUMMARY

The California Department of Transportation (Department) is in the process of replacing the East Span of the San Francisco-Oakland Bay Bridge (SFOBB) with a new bridge immediately to the north of the existing span. The SFOBB East Span crosses San Francisco Bay between Yerba Buena Island (YBI) and the Oakland shoreline.

The Department is currently constructing the Self-Anchored Suspension (SAS) portion of the SFOBB East Span Seismic Safety Project (SFOBB Project). As part of this work, it is necessary to construct temporary towers to support the SAS span during construction. Three of these temporary towers (Temporary Towers D, F, and G) are marine based and required the installation of temporary steel pipe piles.

Pile driving has the potential to harass marine mammals that are swimming, foraging, and resting in the project vicinity. Under the Marine Mammal Protection Act of 1972, the Department had been issued an Incidental Harassment Authorizations (IHA) from the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA-Fisheries) to incidentally take a small number of California sea lions (*Zalophus californianus*), Pacific harbor seals (*Phoca vitulina richardii*), harbor porpoises (*Phocoena phocoena*), and gray whales (*Eschrichtius robustus*) by harassment incidental to construction.

On March 3, 2008 the Department submitted a request to NOAA-Fisheries for renewal of an IHA. An IHA was previously issued to the Department for the SFOBB Project on May 2, 2007 and expired on May 1, 2008. The driving of piles at the temporary towers was scheduled to commence in June 2008. NOAA-Fisheries informed the Department they would not be able to issue the IHA before June 2008. As construction of the temporary towers was on the critical path NOAA-Fisheries authorized the Department to proceed with pile driving during the renewal process. The Department, however was required to adhere to requirements of the 2007 IHA, including the establishment of a marine mammal safety zone (MMSZ) corresponding to areas where sound pressure levels from pile driving could result in behavioral impacts to marine mammals.

The 2007 IHA required the Department to establish a preliminary MMSZ of 500 meters (1,640 feet) around each impact pile driving site before pile driving commenced. Once pile driving commenced the Department would use acoustical monitoring data to determine the radii at which underwater sound levels were anticipated to equal or exceed 180 decibel (dB) root mean square of the sound pressure level referenced to 1 micro pascal (re 1 $\mu\text{Pa}_{\text{rms}}$) for cetaceans and 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ for pinnipeds.

However, during the IHA renewal process NOAA-Fisheries required the use of a more conservative MMSZ based on a 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ isopleth for all marine mammals during impact pile driving. During the renewal process NOAA-Fisheries required that a MMSZ be used during vibratory pile driving based on a 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$ isopleth. The request from NOAA-Fisheries to determine a MMSZ for vibratory pile driving based on 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$ did not come until pile driving had been completed at Temporary Tower D and was more than halfway completed at Temporary Tower F.

Pursuant to the SFOBB Project Revised Marine Mammal Monitoring Plan (Caltrans 2004a), observers surveyed the MMSZ to ensure that no marine mammals were seen within the MMSZ before pile driving of a pile segment began. If marine mammals were found within the MMSZ,

pile driving of the segment would be delayed until the marine mammals had moved beyond the MMSZ, either verified through sighting by an observer or by waiting until enough time had elapsed without a sighting (15 minutes) to assume that the animal had moved beyond the MMSZ.

If a marine mammal were to enter the MMSZ after pile driving of a segment had commenced, pile driving would continue unabated with monitors recording the number and behavior of the marine mammals.

Marine mammal monitoring was conducted at least 30 minutes prior to, during and following pile driving, from June 2008 through May 2009. Monitoring was also conducted at the YBI harbor seal haul-out site because of its close proximity to the temporary towers, approximately 0.9 to 1.6 kilometers (0.6 to 0.9 miles). A harbor seal haul-out site at Point Bonita, in the Marin Headlands, west of the Golden Gate Bridge, approximately 15.0 kilometers (9.3 miles) west of the temporary towers, was also monitored as a control site to the YBI haul-out (i.e., a haul-out site that has no potential for impacts from SFOBB Project pile driving activities).

In accordance with the 2007 IHA, the initial MMSZ was set at 500 meters (1,640 feet) until hydroacoustic monitoring data could be obtained to determine the actual radii at which underwater sound pressure levels would equal or exceeded the specified criteria.

Hydroacoustic monitors collected underwater sound data during initial impact pile driving events at each of the three marine based temporary towers to determine the distance to the 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$. The distances to the 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level varied considerably from tower to tower. Based on hydroacoustic data, the MMSZ distances for Temporary Tower D were set at 500 meters (1,640 feet) for the northwest and southwest quadrants, 1,000 meters (3,280 feet) for the northeast quadrant, and 2,000 meters (6,561 feet) for southeast quadrant. For Temporary Towers F and G the distance to the 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ MMSZ varied in different directions from the pile. In all directions the distance was less than 1,000 meters (3,280 feet). Therefore, for the purpose of monitoring the MMSZ at Temporary Towers F and G was set at 1,000 meters (3,280 feet) in all directions from the impact pile driving.

The request from NOAA-Fisheries to determine a MMSZ for vibratory pile driving based on 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$ did not come until pile driving had been completed at Temporary Tower D and was more than halfway completed at Temporary Tower F. During vibratory pile driving at Temporary Towers F and G, hydroacoustic monitors were unable to locate the distance at which vibratory pile driving sound levels dropped to 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$. Ambient sound levels in the Bay near the project site often equaled or exceeded 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$. At a distance of 1,900 meters (6,234 feet) from the vibratory pile driving, monitors could no longer distinguish the pile driving sound from the ambient noise. The Department notified NOAA-Fisheries of this limitation and for the purpose of marine mammal monitoring the MMSZ was set at 1,900 meters (6,234 feet) for all vibratory pile driving after that point.

For informational purposes, hydroacoustic monitors collected sound data to determine the distance to the 180 and 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ thresholds (the thresholds specified in 2007 IHA). The maximum distance to the 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ threshold occurred at Temporary Tower D in the southeasterly direction where the distance was determined to be approximately 150 meters (492 feet). The distance to the 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 100 meters (328 feet) at Temporary Tower F. The distance to the 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 50 meters (164 feet) at Temporary Tower G. The maximum distance to the 180 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level during impact pile driving at Temporary Tower D was approximately 500 meters (1,640 feet). The distance to the 180 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 375 meters (1,230 feet) at Temporary

Tower F. The distance to the 180 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 400 meters (1,312 feet) at Temporary Tower G.

Monitoring of marine mammals was conducted on 46 days during open-water pile driving for the temporary towers. Monitoring was also conducted for at least 30 minutes prior to and after the pile driving. Eighty-five pinnipeds were observed, including eighty harbor seals (approximately 94% of observations) and five California sea lions (approximately 6% of observations). No gray whales (*Eschrichtius robustus*) or harbor porpoises (*Phocoena phocoena*) were observed. The number of harbor seals observed each day ranged from 0 to 6 and the number of sea lions ranged from 0 to 1. Pinnipeds were sighted on 37 of the 46 total observation days, harbor seals were sighted on 36 days and sea lions were observed on 5 days.

Marine mammals were observed within the MMSZ after pile driving had commenced on eight of the observation days and pile driving was delayed on three occasions when marine mammals were observed in the MMSZ just prior to the start of pile driving for the day or after an extended break. On two of those occasions (August 11, 2008 and November 19, 2008), pile driving began 15 minutes after the last sighting of those seals. On the third occasion (October 23, 2008), pile driving began after the monitors observed the seal swim beyond the confines of the MMSZ.

On two occasions harbor seals were observed outside on the MMSZ during pile driving (two seals on July 30, 2008 and one seal on November 6, 2008). The marine mammal monitors did not observe any indications that the three harbor seals seen outside of the MMSZ during pile driving or the eleven harbor seals and one sea lion that entered the MMSZ during pile driving were disturbed or harmed due to SFOBB Project construction activities.

As many as 198 harbor seals hauled out at the YBI haul-out site on a single observation day and as many as 99 seals hauled out at the control site at Point Bonita on a single observation day. Pile driving was barely audible to the marine mammal monitors located above the YBI haul-out site. There was no reaction by harbor seals to the pile driving. On occasion, seals were disturbed by activities unrelated to SFOBB construction. Typical disturbances were noise generated on the existing SFOBB (i.e., trucks, horns, backfires, etc.) or from wake waves from boats, and boaters or kayakers approaching the haul-out site. The range of responses to these disturbances varied from a head lift response of a few seals to a flush of a large number of seals near the water.

INTRODUCTION

The California Department of Transportation (Department) is in the process of replacing the East Span of the San Francisco-Oakland Bay Bridge (SFOBB) with a new bridge immediately to the north of the existing span. The SFOBB East Span crosses San Francisco Bay between Yerba Buena Island (YBI) and the Oakland shoreline (see Figure 1).



Figure 1. Project Location Map

PROJECT DESCRIPTION

The Department is currently constructing the Self-Anchored Suspension (SAS) portion of the SFOBB East Span Seismic Safety Project (SFOBB Project) (see Figure 2). As part of this work, it is necessary to construct temporary towers to support the SAS span during construction. Three of these temporary towers (Temporary Towers D, F, and G) are marine based and required installation of temporary steel pipe piles.

Temporary Tower D

Construction of Temporary Tower D required the installation of sixteen, 42-inch diameter temporary falsework piles, eight piles for the south-node and eight for the north-node. Installation of Temporary Tower D falsework piles commenced on June 12, 2008 and occurred intermittently through August 11, 2008. These piles were primarily installed using a vibratory hammer. A Menck500 hydraulic hammer was then used to drive these piles to their final tip elevation.

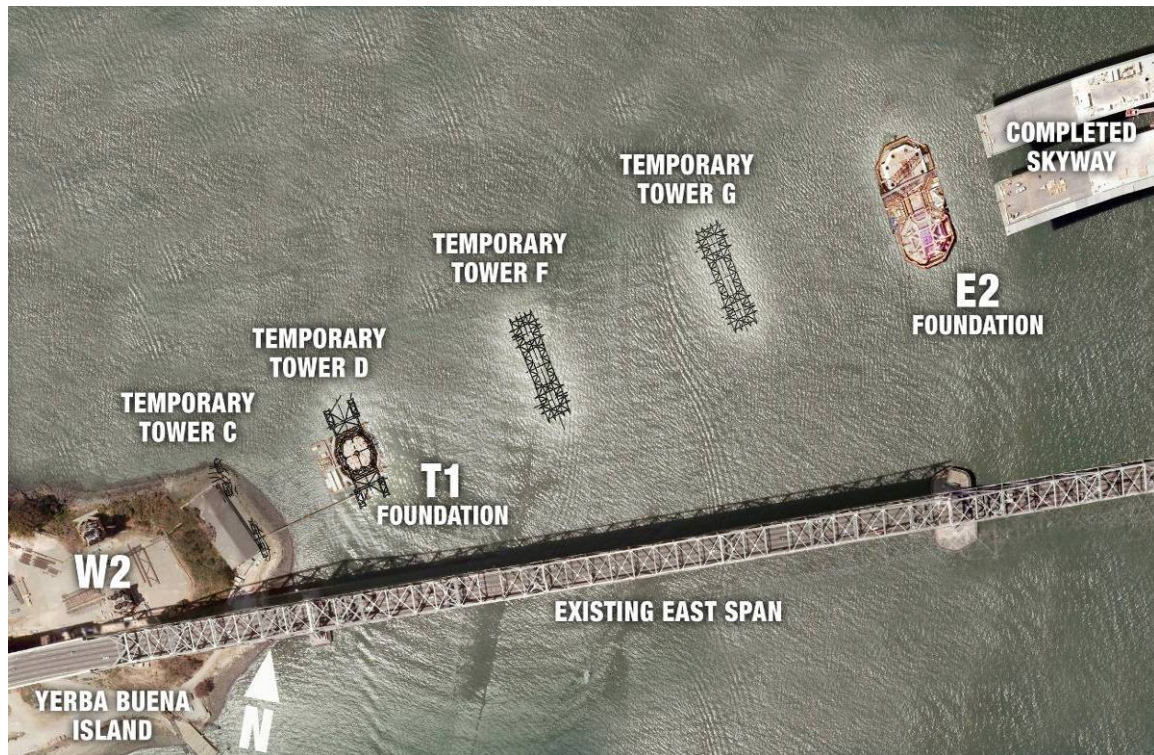


Figure 2. Self-Anchored Suspension Structures

Temporary Towers F and G

Construction of Temporary Towers F and G required the installation of 36 piles for each tower (18 for the south-node and 18 piles for north-node). Of the 36 piles, 16 are 48-inch diameter piles and 20 are 42-inch diameter piles. Each of these piles has a bottom and top segment. The bottom segment of each pile was installed with a vibratory hammer. After the top segment was welded to the bottom segment, the pile was vibrated down to the extent possible. The piles were then impact driven to their final tip elevation with a Delmag D-100 diesel impact hammer.

Installation of Temporary Tower F south-node piles commenced on October 21, 2008 and occurred intermittently through November 14, 2008. Installation of Temporary Tower F north-node piles commenced on December 9, 2008 and occurred intermittently through January 29, 2009. Installation of Temporary Tower G south-node piles commenced on March 4, 2009 and occurred intermittently through March 26, 2009. Installation of Temporary Tower G north-node piles commenced on April 20, 2009 and occurred intermittently through May 15, 2009.

BACKGROUND

Under the Marine Mammal Protection Act of 1972, the Department was issued an Incidental Harassment Authorization (IHA) on May 1, 2007 from the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA-Fisheries) to incidentally take a small number of California sea lions (*Zalophus californianus*), Pacific harbor seals (*Phoca vitulina richardsi*), harbor porpoises (*Phocoena phocoena*), and gray whales (*Eschrichtius robustus*) by harassment incidental to construction. There is concern by NOAA-Fisheries that the impulse sound of pile driving in excess of 180 decibels (dB) root mean square of the sound pressure level referenced to 1 micro pascal (re 1 $\mu\text{Pa}_{\text{rms}}$) for cetaceans (e.g., harbor porpoises and grey whales) and 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ for pinnipeds (e.g., harbor seals and sea lions) could harass marine mammals that may occur in the area. A comprehensive Marine Mammal Monitoring Plan for the driving of piles was submitted to NOAA-Fisheries in May 2002. A revision was submitted in February 2004.

On March 3, 2008 the Department submitted a request to NOAA-Fisheries for renewal of an IHA. An IHA was previously issued to the Department for this activity on May 2, 2007 and expired on May 1, 2008. The driving of piles at the temporary towers was scheduled to commence in June 2008. NOAA-Fisheries informed the Department they would not be able to issue the IHA before June 2008. As construction of the temporary towers was on the critical path NOAA-Fisheries authorized the Department to proceed with pile driving during the renewal process. The Department, however was required to adhere to requirements of the 2007 IHA, including the establishment of a marine mammal safety zone (MMSZ) corresponding to areas where sound pressure levels from pile driving could result in behavioral impacts to marine mammals.

The 2007 IHA required the Department to establish a preliminary MMSZ of 500 meters (1,640 feet) around each impact pile driving site before pile driving commenced. Once pile driving commenced the Department would use acoustical monitoring data to determine the radii at which underwater sound levels were anticipated to equal or exceed 180 decibel (dB) root mean square of the sound pressure level referenced to 1 micro pascal (re 1 $\mu\text{Pa}_{\text{rms}}$) for cetaceans and 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ for pinnipeds.

However, during the IHA renewal process NOAA-Fisheries required the use of a more conservative MMSZ based on a 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ isopleth for all marine mammals during impact pile driving. During the renewal process NOAA-Fisheries required that a MMSZ be used during vibratory pile driving based on a 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$ isopleth. The request from NOAA-Fisheries to determine a MMSZ for vibratory pile driving based on 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$ did not come until pile driving had been completed at Temporary Tower D and was more than halfway completed at Temporary Tower F.

Harbor seals utilize San Francisco Bay area throughout the year using offshore rocks, coves or estuary mud flats to haul-out on to rest. The number of seals at haul-out sites fluctuates during the year with numbers increasing during the winter herring runs and during the spring molt. The closest harbor seal haul-out site is located on the southwest side of YBI and is approximately 0.9 to 1.6 kilometers (0.6 to 0.9 miles) from the temporary towers (see Figure 3). As many as 200 seals may haul out at this location on any given day. The Point Bonita haul-out site is located in the Marine Headlands, west of the Golden Gate, approximately 15.0 kilometers (9.3 miles) west of the temporary towers (see Figure 3). Harbor seals also use San Francisco Bay to forage and rear their young, although only several pups a year are born at the YBI haul-out site.

While California sea lions are present in San Francisco Bay throughout the year, the largest numbers are found in the late summer and fall after the breeding season. The main haul-out site is Pier 39, in San Francisco (see Figure 3), where sea lions use the docks to haul-out (approximately 4.6 to 5.2 kilometers [2.9 to 3.2 miles] west of the temporary towers). Sea lions rest and forage within San Francisco Bay, but most of the population returns south to the Channel Islands off the coast of Southern California to breed, give birth, and nurse their pups. Año Nuevo Island, 80 kilometers (50 miles) south of San Francisco Bay is the nearest rookery, but is relatively small with less than 100 pups born each year.

Harbor porpoises inhabit the coastal waters from approximately Point Conception, California to Alaska (Leatherwood et al. 1982; Gaskin 1984). The harbor porpoises found near and within the San Francisco Bay are part of the San Francisco-Russian River stock that extends from south of the Golden Gate Bridge to Point Arena, California (Carretta et al. 2005). Harbor porpoises are very rarely seen in the project vicinity.

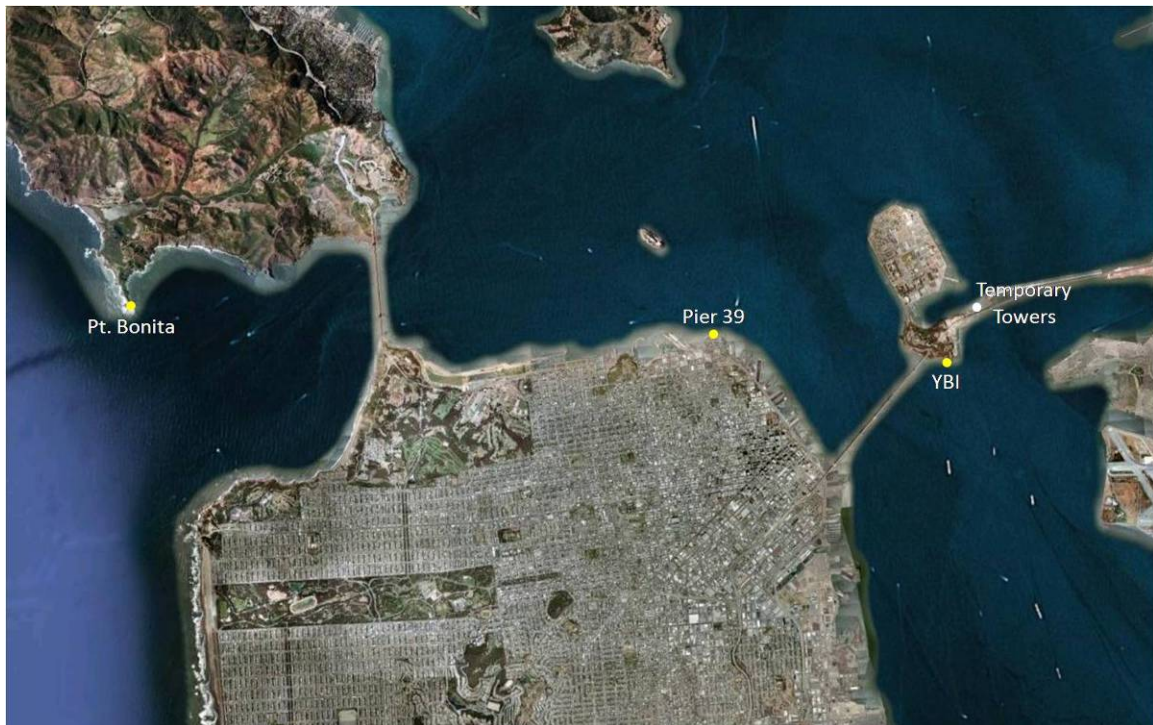


Figure 3. Haul-out Site Locations

Gray whales can be occasionally found within San Francisco Bay from January through June during their northward migration. Most whales are observed in the northern portion of the Bay or traveling underneath the west span of the SFOBB and have rarely been seen near the East Span. Whales entering the Bay may remain for a short time to forage, may be confused juveniles, or may be injured or ill and will strand within the Bay.

MARINE MAMMAL SAFETY ZONES

In accordance with the May 2, 2007 IHA, the initial MMSZ was set at 500 meters (1,640 feet) until hydroacoustic monitoring data could be obtained to determine the actual radii at which underwater sound pressure levels would equal or exceeded the NOAA-Fisheries specified criteria.

Hydroacoustic monitors collected underwater sound data during initial impact pile driving events at each of the three marine based temporary towers to determine the distance to the 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ threshold. The distances to the 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level varied considerably from tower to tower. Based on hydroacoustic data, the MMSZ distances for Temporary Tower D were set at 500 meters (1,640 feet) for the northwest and southwest quadrants, 1,000 meters (3,280 feet) for the northeast quadrant, and 2,000 meters (6,561 feet) for southeast quadrant. For Temporary Towers F and G the distance to the 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ MMSZ varied in different directions from the pile. In all directions the distance was less than 1,000 meters (3,280 feet). Therefore, for the purpose of monitoring, the MMSZ was set at 1,000 meters (3,280 feet) in all directions from the impact pile driving.

The request from NOAA-Fisheries to determine a MMSZ for vibratory pile driving based on 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$ did not come until pile driving had been completed at Temporary Tower D and was more than halfway completed at Temporary Tower F. NOAA-Fisheries was concerned about the potential effects of continuous pile driving sound. During vibratory pile driving at Temporary Towers F and G, hydroacoustic monitors were unable to locate the distance at which vibratory pile driving sound levels dropped to 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$. Ambient sound levels in the Bay near the project site often equaled or exceeded 120 dB re 1 $\mu\text{Pa}_{\text{rms}}$. At a distance of 1,900 meters (6,234 feet) from the vibratory pile driving, monitors could no longer distinguish the pile driving sound from the ambient noise. The Department notified NOAA-Fisheries of this limitation and for the purpose of marine mammal monitoring, the MMSZ was set at 1,900 meters (6,234 feet) for all vibratory pile driving after that point.

For informational purposes, hydroacoustic monitors collected sound data to determine the distance to the 180 and 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ thresholds (the thresholds specified in 2007 IHA). The maximum distance to the 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ threshold occurred at Temporary Tower D in the southeasterly direction where the distance was determined to be approximately 150 meters (492 feet). The distance to the 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 100 meters (328 feet) at Temporary Tower F. The distance to the 190 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 50 meters (164 feet) at Temporary Tower G. The maximum distance to the 180 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level during impact pile driving at Temporary Tower D was approximately 500 meters (1,640 feet). The distance to the 180 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 375 meters (1,230 feet) at Temporary Tower F. The distance to the 180 dB re 1 $\mu\text{Pa}_{\text{rms}}$ level was approximately 400 meters (1,312 feet) at Temporary Tower G.



Figure 4. Map of Marine Mammal Safety Zones and Observation Sites Used During Pile Driving at Temporary Towers F and G

MONITORING METHODS

Marine mammal monitoring for the SFOBB Project was conducted during construction of temporary towers from June 2008 through May 2009. There were 46 days of marine mammal monitoring for open-water pile driving at Temporary Towers D, F and G. Monitoring was also conducted during 21 days at the YBI harbor seal haul-out site on the southwest side of YBI. A control haul-out site (i.e., a haul-out site that has no potential for impacts from SFOBB Project pile driving activities), Point Bonita, in the Marine Headlands, west of the Golden Gate, approximately 15.0 kilometers (9.3 miles) west of the temporary towers, was also monitored for eight days to establish a baseline for harbor seal activity at a haul-out site.

Construction Area

A minimum of three NOAA-fisheries approved monitors, and some times as many as five monitors, were used during open-water pile driving for visual coverage of the MMSZ. The monitors concentrated on the area of the MMSZ, but observed beyond the MMSZ depending on weather conditions. Monitoring was conducted from the pile driving barge (see Figure 5), west end of the Skyway portion of the new bridge, and east end of YBI and/or south end of Treasure Island (see Figure 4). The sites used during each monitoring period depended on the location of the construction activities and the availability of access. Each of these observation sites was preferable to small boats because they were elevated above the water and provided a better angle for observation.

The marine mammal observers initiated monitoring at least 30 minutes prior to the start of all in-water impact pile driving and all vibratory pile driving at Temporary Towers F and G (see

Background). If marine mammals were visually sighted within the MMSZ prior to the start of pile-driving, the monitors would contact the Resident Engineer (or other authorized individual) who was required to have the construction contractor delay pile driving until the marine mammal had moved beyond the applicable MMSZ. Verification of the marine mammal departing the MMSZ required either visual sighting or at least 15 minutes elapsing following the last observation of the animal. If marine mammals were sighted within the MMSZ after pile driving had begun, the biologists recorded the species, numbers and behavior of the animal and reported the observation to Department environmental staff within 24 hours of the sighting.



Figure 5. Example of an Observation Site (showing a marine mammal observer at the end of one of the pile driving barges)

Each observer had a pair of high quality binoculars (8x42 or 10x42 power), a data book to record observations, and a compass and laser rangefinder (Bushnell 1000 Pro) to determine the position of marine mammals. Each monitor was also equipped with a radio or cell phone to communicate with the other observers to track any marine mammals as they moved through the observation areas and to notify the lead monitor if a marine mammal was in the MMSZ, so that he could notify the Department's representative.

The following information was recorded for each observation of a marine mammal: species, number of animals, age class (when possible), gender (when possible), position relative to the MMSZ and to the pile being driven, direction of movement, and general behavior. General behavior included whether the animal was stationary or swimming at the surface (including relative swim speed) and if the animal appeared to respond to or notice the pile driving activity.

Environmental conditions were recorded throughout the monitoring period and included: wind speed, wind direction, wind chop or sea state (small waves caused by the wind - based on the

Beaufort Scale), distance of visibility (affected by fog or glare), air temperature, rain, and tide level. Meteorological data was supplemented using the NOAA Physical Oceanography Real Time System (PORTS) which includes recorded observations every six minutes from sensors throughout San Francisco Bay.

Harbor Seal Haul-out Sites

The YBI haul-out site is located in a semi-protected cove on the southwestern side of the island (see Figures 3 and 4). The YBI site consists of a rocky area that is used by seals when it is exposed at lower tides (Figure 6). The property for both the haul-out site and the observation area is owned by the United States Coast Guard (USCG), and is the residence for the Vice Admiral of the USCG. All access to the observation site was coordinated with and approved by the USCG with limitations imposed, such as 48-hour notice, access only from 0900 to 1600 hours, and no access on holidays and weekends. Due to changes in the construction schedule, access was not always possible. The monitoring at YBI was conducted in conjunction with the Marine Mammal Center (Sausalito, CA).



Figure 6. Harbor Seals Resting on the Lower Rocks at the YBI Haul-out Site

The Point Bonita haul-out site, which is the control site, is located in the Marine Headlands at the western edge of San Francisco Bay, approximately 15.0 kilometers (9.3 miles) west of the temporary towers; therefore, is not subjected to any of the pile driving noise that could impact YBI. It consists of rocky and sandy coves where seals haul-out on lower tides below 1.3 meters (4.3 feet). Like the YBI haul-out site, the Point Bonita haul-out site is subject to disturbances from recreation activities (i.e., boats and fishing).

The following information was recorded for each observation of a harbor seal at the haul-out sites: age class, gender (when possible), red coats, and general behavior. Disturbances were recorded, including the source of the disturbance (e.g., boat, aircraft, humans, etc.), distance from the haul-out site to the disturbance, reaction of the seals, and the estimated recovery time from the disturbance.

Environmental conditions were recorded throughout the monitoring period and included: wind speed, wind direction, wind chop (small waves caused by the wind - based on the Beaufort Scale), visibility (fog or glare), temperature, and tide level.

RESULTS

Construction Area

During marine mammal monitoring (conducted at least 30 minutes prior to, during and after open-water pile driving), 85 pinnipeds were observed, including 80 harbor seals (approximately 94% of observations) and 5 California sea lions (6% of observations). Pinnipeds were sighted on 37 of the 46 total observation days with harbor seals being sighted on 36 days and sea lions being sighted on 5 days (see Table 1). The number of harbor seals observed each day ranged from 0-6 individuals and the number of sea lions observed ranged from 0-1 individual. Eleven harbor seals and one sea lion entered the MMSZ while pile driving was being conducted. None of these marine mammals showed any startle response, but swam slowly through the area or were foraging. The most common pattern of movement was harbor seals swimming to the southwest past the temporary towers toward the southern end of YBI or west into Clipper Cove between YBI and Treasure Island.

On two occasions harbor seals were observed outside on the MMSZ during pile driving (two seals on July 30, 2008 and one seal on November 6, 2008). The marine mammal monitors did not observe any indications that the three harbor seals seen outside of the MMSZ during pile driving were disturbed due to SFOBB Project construction activities.

Table 1. Summary of marine mammal monitoring conducted during pile driving for the temporary towers.

Temporary Tower D

Date	Harbor Seals	Sea Lions	Number Outside MMSZ During Pile Driving	Number Inside MMSZ During Pile Driving
June 12, 2008	1	0	0	0
June 13, 2008	2	0	0	0
June 20, 2008	3	0	0	0

June 23, 2008	1	0	0	0
June 24, 2008	1	0	0	1
July 8, 2008	5	1	0	0
July 9, 2008	5	0	0	0
July 10, 2008	4	1	0	0
July 29, 2008	3	0	0	0
July 30, 2008	2	0	2	0
August 11, 2008	2	0	0	0*

Temporary Tower F

Date	Harbor Seals	Sea Lions	Number Outside MMSZ During Pile Driving	Number Inside MMSZ During Pile Driving
October 23, 2008	2	0	0	0*
November 1, 2008	0	0	0	0
November 5, 2008	1	0	0	0
November 6, 2008	2	0	1	1
November 7, 2008	3	0	0	0
November 8, 2008	1	0	0	0
November 11, 2008	0	0	0	0
November 13, 2008	0	0	0	0
November 14, 2008	1	0	0	0
December 1, 2008	2	0	0	0
December, 2 2008	0	0	0	0
December 9, 2008	2	0	0	0
December 11, 2008	2	0	0	0
December 17, 2008	0	0	0	0
December 19, 2008	2	0	0	0*
January 8, 2009	1	1	0	1 (sea lion)
January 9, 2009	2	0	0	0
January 12, 2009	6	0	0	0
January 15, 2009	0	1	0	0
January 21, 2009	1	0	0	0
January 29, 2009	0	0	0	0

Temporary Tower G

Date	Harbor Seals	Sea Lions	Number Outside MMSZ During Pile Driving	Number Inside MMSZ During Pile Driving
March 4, 2009	0	0	0	0
March 6, 2009	2	0	0	0
March 13, 2009	0	0	0	0
March 19, 2009	3	0	0	0
March 20, 2009	1	0	0	0
March 25, 2009	3	0	0	1
March 26, 2009	1	0	0	1
April 20, 2009	0	0	0	0
April 22, 2009	2	0	0	2
April 30, 2009	1	0	0	0
May 1, 2009	2	0	0	0
May 7, 2009	2	0	0	0
May 12, 2009	3	1	0	3
May 15, 2009	3	0	0	2
Overall Total (Towers D, F and G)	80	5	3	12

* A seal was observed in the MMSZ just prior to pile driving therefore pile driving was delayed until the seal had not been seen for 15 minutes or the observers saw the seal swim out of the MMSZ.

On three occasions pile driving was delayed between 5-15 minutes due to observations of harbor seals in the MMSZ just prior to the start of pile driving. On two of the occasions (August 11, 2008 and November 19, 2008), pile driving began 15 minutes after the last sighting of the seals. During the third occasion (October 23, 2008), the monitors observed the seal repeatedly surfacing and then swimming out of the MMSZ. Due to its size and the track it was on, the observers were confident that it was the same seal. Therefore, pile driving commenced five minutes after the seal was observed leaving the MMSZ.

No gray whales or harbor porpoises were observed in the construction area and there were no reports of cetaceans near the construction area during that time.

Harbor Seal Haul-out Sites

Monitoring at the YBI haul-out was conducted on 21 days. Monitoring at the Pt. Bonita haul-site was conducted on seven days.

From 0 to 198 seals were observed at the YBI haul-out site and 0 to 99 seals were observed at the Pt. Bonita haul-out site during monitoring (see Table 2). The most common disturbances to the marine mammals at the YBI haul-out site were wakes from of large boats (ferry boats and large container ships), boats or kayaks that came too close to the haul-out site, and noise generated on the existing SFOBB (i.e., trucks, horns, backfires, etc.). The marine mammal monitors at the YBI haul-out site could only faintly and intermittently hear the pile driving from where they were positioned, approximately 40 meters (131 feet) above the haul-out site. Pile driving was conducted on four out of the 21 days of YBI haul-out site monitoring. None of the monitors reported any disturbances due to pile driving.

Table 2. Summary of marine mammal monitoring at the YBI and Point Bonita haul-out sites.

Monitoring Date	Time Frame	Site	Harbor Seals Minimum	Harbor Seals Maximum	Pile Driving	Disturbance Type
June 7, 2008	0730 - 1145	YBI	129	135	N	None
June 20, 2008	0600 - 1000	YBI	0	198	Y	None
July 1, 2008	1330 - 1730	Pt. Bonita	0	18	N	None
July 4, 2008	0600 - 1000	YBI	0	178	N	None
July 18, 2008	0600 - 1000	YBI	159	178	N	None
August 1, 2008	0600 - 1000	YBI	98	127	N	None
August 17, 2008	0600 - 1000	YBI	18	98	N	Cargo ship
August 30, 2008	1600 - 1930	YBI	152	179	N	None
September 12, 2008	1430 - 1830	YBI	96	102	N	None
September 14, 2008	1500 - 1900	Pt. Bonita	0	32	N	None
October 24, 2008	1230 - 1630	Pt. Bonita	0	22	N	None
October 25, 2008	1430 - 1830	YBI	0	104	N	Cargo ship, traffic noise
November 21, 2008	1030 - 1430	Pt. Bonita	0	1	N	None
November 22, 2008	1230 - 1630	YBI	16	21	N	None
December 5, 2008	0830 - 1230	Pt. Bonita	0	29	N	None
December 9, 2008	1300 - 1700	YBI	63	60	Y	None
December 19, 2008	0900 - 1300	Pt. Bonita	0	99	Y	None
December 20, 2008	1100 - 1500	YBI	69	71	N	None
January 18, 2009	0930 - 1330	Pt. Bonita	0	24	N	None
January 21, 2009	1330 - 1730	YBI	0	61	Y	Cargo ship, traffic noise

February 4, 2009	1130 - 1530	YBI	84	86	N	None
March 6, 2009	1230 - 1630	YBI	84	94	Y	Cargo ship, traffic noise
March 22, 2009	1400 - 1800	YBI	174	188	N	Cargo ship, traffic noise
April 4, 2009	1300 - 1700	YBI	111	138	N	Cargo ship, traffic noise
April 18, 2009	1200 - 1600	YBI	102	124	N	Cargo ship, traffic noise
April 26, 2009	0600 - 1000	YBI	48	52	N	Cargo ship, traffic noise & kayaks
May 15, 2009	0900 - 1300	YBI	69	97	Y	Cargo ship, traffic noise
May 29, 2009	0830 - 1230	YBI	129	146	N	Cargo ship, traffic noise

CONCLUSION

The number of marine mammals observed in the construction area was relatively small, but within the same range as that of other marine mammal monitoring for the SFOBB Project (Caltrans 2004b, 2004c, 2005, and 2006). The results of monitoring in the construction area showed that most of the harbor seals appeared to be transiting through the area, perhaps heading to the haul-out site on YBI, and generally were only observed for brief periods of time. Several seals did appear to be foraging in the project vicinity during both impact and vibratory pile driving. This was expected because the Coast Guard and Clipper Cove areas are known harbor seal foraging areas and are close to the YBI haul-out site. The marine mammal monitors did not observe any indications that the three harbor seals seen outside of the MMSZ during pile driving, or the twelve marine mammals that entered the MMSZ after pile driving had commenced, were disturbed due to SFOBB Project construction activities. The lack of response by the pinnipeds is an indication that the MMSZs were sufficient at reducing the exposure of both underwater and airborne sounds.

The pile driving noise could only be faintly heard by the monitors at the YBI haul-out site. There was no evidence that pile driving affected the harbor seals located at the haul-out site. The number of harbor seals hauled out was affected by tide level and disturbances such as boats or kayaks nearing the seals or boat wakes that would wash the seals off the rocks.

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