SFCTA Contract Number 99/00-7

South Access to the Golden Gate Bridge

DOYLE DRIVE

FOURTH FINDING OF EFFECT ADDENDUM

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Fourth Finding of Effect Addendum

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ACRONYMS AND ABBREVIATIONS

ACHP	ADVISORY COUNCIL ON HISTORIC PRESERVATION
APE	AREA OF POTENTIAL EFFECTS
ATP	ARCHAEOLOGICAL TREATMENT PLAN
BETP	BUILT ENVIRONMENT TREATMENT PLAN
CALTRANS	CALIFORNIA DEPARTMENT OF TRANSPORTATION
CEQA	CALIFORNIA ENVIRONMENTAL QUALITY ACT
CFR	CODE OF FEDERAL REGULATIONS
FHWA	FEDERAL HIGHWAY ADMINISTRATION
FOE	FINDING OF EFFECT
GGB&HD	GOLDEN GATE BRIDGE & HIGHWAY DISTRICT
GGBHTD	GOLDEN GATE BRIDGE HIGHWAY AND TRANSPORTATION DISTRICT
GPR	GROUND PENETRATING RADAR
HABS	HISTORIC AMERICAN BUILDINGS SURVEY
HAER	HISTORIC AMERICAN ENGINEERING RECORD
MIP	MITIGATION IMPLEMENTATION PLAN
NHPA	NATIONAL HISTORIC PRESERVATION ACT
NPS	NATIONAL PARK SERVICE
PA	PROGRAMMATIC AGREEMENT
PNHLD	PRESIDIO NATIONAL HISTORIC LANDMARK DISTRICT
PRESIDIO	PRESIDIO OF SAN FRANCISCO
PROPOSED PROJECT	CONSTRUCTION OF THE BATTERY TUNNELS
SFCTA	SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY
SHPO	STATE HISTORIC PRESERVATION OFFICER
TOP	TREATMENT OVERSIGHT PANEL
TRUST	PRESIDIO TRUST
UNDERTAKING	SOUTH ACCESS TO THE GOLDEN GATE BRIDGE–DOYLE DRIVE PROJECT
VA	DEPARTMENT OF VETERANS' AFFAIRS

SECTION 1: INTRODUCTION

1.1 PROJECT OVERVIEW AND REGULATORY CONTEXT

The Federal Highway Administration (FHWA), California Department of Transportation (Caltrans), and the San Francisco County Transportation Authority (SFCTA) are replacing Doyle Drive with the Presidio Parkway (the South Access to the Golden Gate Bridge—Doyle Drive Project [undertaking]) in order to improve the seismic, structural, and traffic safety of the roadway within the setting and context of the Presidio of San Francisco (Presidio) and its purpose as a national park. The FHWA serves as the lead federal agency, and the SFCTA serves as the lead agency for the purposes of the California Environmental Quality Act (CEQA). Cooperating agencies for the undertaking are the National Park Service (NPS), the Presidio Trust (Trust), and the Department of Veterans' Affairs (VA). Caltrans and the Golden Gate Bridge Highway and Transportation District (GGBHTD) are the responsible agencies under CEQA.

The purpose of this finding of effect (FOE) addendum is to document the FHWA's continuing efforts to meet the requirements of Section 106 of the National Historic Preservation Act (NHPA) by applying the Criteria of Adverse Effect, set forth in the Code of Federal Regulations (CFR) Title 36, Section 800.5, to specific historic properties within the undertaking area of potential effects (APE) for which effects may have changed because of project refinements. This document also serves to demonstrate the FHWA's compliance with 36 CFR 800.10, Special Requirements for Protecting National Historic Landmarks.

This FOE addendum supplements the information provided in the first addendum FOE (Federal Highway Administration 2007) for the undertaking that was completed in December 2005 (Federal Highway Administration 2005). Since that time, project changes have necessitated additional efforts to identify effects on historic properties. As stated in the first addendum FOE, the FHWA has applied the criteria of adverse effect and determined that the undertaking will have an adverse effect on historic properties within the APE pursuant to 36 CFR 800.5(a) and (d)(2) and, with the cooperation and assistance of Caltrans, is consulting with the State Historic Preservation Officer (SHPO) regarding the resolution of adverse effects pursuant to 36 CFR 800.6. The FHWA has notified the Advisory Council on Historic Preservation (ACHP) and the U.S. Secretary of the Interior of the finding of adverse effect upon the Presidio National Historic Landmark District (PNHLD) pursuant to 36 CFR 800.6(a)(1)(i)(B), thereby affording the ACHP the opportunity to participate in consultation.

This addendum FOE was necessitated by recently obtained design information related to construction of the Battery Tunnels (proposed project) associated with the undertaking that may alter a contributing element of the PNHLD located within the APE (Figure 1). The contributor potentially affected is Battery Slaughter, located on the north side of Doyle Drive north of Lincoln Boulevard and the San Francisco National Cemetery, and west of the Main Post area of the Presidio. Specifically, northern portions of Battery Slaughter, if extant, may be buried under the at-grade Doyle Drive roadway at this location. If so, it may be encountered during tunnel excavation and construction. If encountered, those portions of the battery located within the tunnel alignment will be demolished. While studies completed to locate these potentially buried portions of the battery were inconclusive, it is assumed that construction of the Battery Tunnels will adversely affect Battery Slaughter features.

This report is organized as follows: Section 2 presents the identification and description of the Battery; Section 3 is the application of the criteria of adverse effect to Battery Slaughter; and

Section 4 presents conclusions of the findings. Figures depicting the APE, historic maps, engineering plans, and photographs are provided in Appendix A as Figures 1–15. The ARUP study completed to determine the limits of buried portions of Battery Slaughter is presented in Appendix B.

Refer to the final FOE (Federal Highway Administration 2005) and the first addendum FOE (Federal Highway Administration 2007) appendices for additional information, including tables listing all other historic properties within the APE and effects on those historic properties. The final FOE also includes a conceptual mitigation plan that has been used as the basis for developing the Programmatic Agreement (PA) to address adverse effects the undertaking will have on historic properties, and a report on the cultural landscape of the PNHLD. However, no mitigation was developed for Battery Slaughter because no effects were anticipated at the time the FOE and subsequent FOE addenda were developed.

1.2 SUMMARY OF SECTION 106 COMPLIANCE ACTIVITIES

An archaeological survey report and a historical survey report were produced to identify historic resources within the project area (Jones & Stokes and Albion Environmental 2002), and a finding of effect (the final FOE plus the first FOE Addendum) (Federal Highway Administration 2005 and 2007) was produced to determine the effects of the undertaking on the identified historic resources. Following completion and approval of the final FOE, the FHWA continued the Section 106 process with Caltrans, cooperating agencies, responsible agencies, and other interested parties working toward the PA to resolve adverse effects that the undertaking would have on historic properties in the APE.

On August 27, 2008, a PA was executed among the FHWA, the Trust, the NPS, the SHPO, and the ACHP with Caltrans, the VA, the SFCTA, and the San Francisco Recreation and Parks Department participating in the PA as invited signatories. The PA called for a built environment treatment plan (BETP) and an archaeological treatment plan (ATP) to be developed. Both treatment plans were finalized in February 2009 (California Department of Transportation 2009a; ICF Jones & Stokes 2009).

The PA also required completion of a mitigation implementation plan (MIP) that outlines how the treatment plans will be implemented as the details of project design become available (California Department of Transportation 2009b). The MIP was finalized in June 2009. The first bi-annual status report outlining the compliance process to date was completed in September of 2009. Both the bi-annual status report and the MIP were sent to the signatories of the PA in September 2009.

The PA also requires regular meetings among a Doyle Drive Treatment Oversight Panel (TOP). A TOP was formed to facilitate these meetings and includes professionally qualified representatives from Caltrans, the SFCTA, the Trust, the NPS, and other signatories as appropriate. This group has met monthly since January 2009.

The FOE Addenda supplemented the Section 106 activities by identifying and clarifying the nature of the potential adverse effects of subsequent project refinements on historic properties. The final FOE and the FOE addenda outline in detail the effects of the undertaking on historic properties.

1.3 SUMMARY OF RESOURCES AFFECTED

Previous studies resulted in the determination that four historic properties would be adversely affected.

- The PNHLD—Overall district, contributors, and cultural landscape.
- Doyle Drive—Presidio Viaduct (bridge 34 0019).
- Doyle Drive—Marina Viaduct (bridge 34 0014).
- The Golden Gate Bridge—Doyle Drive as contributor.

It was also determined that two significant resources within the APE, archaeological site CA-SFR-6/26 and the Palace of Fine Arts, would not be adversely affected.

This FOE Addendum supplements the Section 106 activities that have occurred to date by identifying an adverse effect on a previously documented historic resource that is a contributor to the PNHLD, Battery Slaughter. This FOE applies to the area of construction activity that is confined to the present-day northbound Doyle Drive immediately to the south of Battery Slaughter. It is presumed there will be an adverse effect to Battery Slaughter resulting from the excavation and construction of the northbound Battery Tunnel. Specifically, there may be an adverse effect to Contributing Resource F47, Battery Slaughter, which includes the southern walls of the battery that is assumed to be currently buried beneath northbound Doyle Drive. Once this FOE addendum is finalized, the FHWA will continue consultation with the SHPO and the ACHP to resolve the adverse effect identified here. A specific mitigation program will be determined prior to tunnel construction and a mitigation plan will be in place should construction affect the battery.

1.4 AREAS OF POTENTIAL EFFECTS AND IDENTIFICATION OF HISTORIC PROPERTIES

Although Battery Slaughter is within the undertaking APE, Section 1.4 of this report provides information on the revisions to the APE to date for the undertaking. Early in the undertaking, two APEs were established: one focused on archeological resources and one focused on architectural resources. The SHPO concurred with the FHWA regarding the focused APEs for archaeology and architecture on October 31, 2001. The SHPO reconfirmed on December 17, 2007, that both focused APEs appeared adequate and met the definition of an APE set forth in 36 CFR 800.16(d). Since execution of the PA, the APEs for archaeology and architecture were expanded to include additional project design changes extending outside the previously established APE. The cooperating agencies concurred with the revised archaeological and architectural APEs on June 8, 2009, July 15, 2009, and November 10, 2009 (Figure 1).

Consultation with the SHPO on November 10, 2009 resulted in expanding the archaeological APE to match the architectural APE, with the stipulations that this expanded APE be valid only for utility relocation efforts associated with the undertaking, that appropriate review of design plans occurs by the undertaking's cultural resources TOP, and that identification, evaluation, and mitigation consistent with the PA and treatment plans developed for the undertaking are carried out.

Six historic properties exist in the architectural and archaeological APEs: the PNHLD, the Presidio Viaduct on Doyle Drive (Bridge 34 0019), the Marina Viaduct on Doyle Drive (Bridge 34 0014), the Doyle Drive portion of the Golden Gate Bridge, archaeological site CA-SFR-6/26, and the Palace of Fine Arts. There are approximately 280 contributing elements of the PNHLD within the APEs. Approximately 70 contributing elements of the PNHLD are in close proximity to the project area and were addressed in the final FOE because of the potential for them to experience an adverse effect under one or more of the alternatives discussed in that document as well as in the BETP and the MIP.

The final FOE addressed contributing elements of the PNHLD in the vicinity of Battery Slaughter. These include Battery Baldwin and Battery Blaney Road. Battery Baldwin is partially buried under fill associated with the extant Doyle Drive High Viaduct and will not be affected by the undertaking. Battery Blaney Road, a historic access road to the four batteries in this area, will be adversely affected by the undertaking. Battery Blaney Road will be realigned at its intersection with Crissy Field Avenue. As specified in the final FOE, mitigation for the adverse affect on Battery Blaney Road will consist of recording the resource as part of the Historic American Landscape Survey being prepared for the undertaking (Federal Highway Administration 2005).

1.5 AGENCY AND INTERESTED-PARTY CONSULTATIONS

Agency and interested-party consultations have been conducted in compliance with the stipulations of the PA. Specifically, monthly meetings of the TOP keep the cooperating agencies informed regarding the undertaking. In September 2009, all signatories of the PA received the bi-annual report of cultural resources compliance efforts associated with the undertaking. The biannual report included the MIP. Updated letters requesting continued consultation were sent to the four Native American representatives who are invited signatories of the PA.

1.6 PROJECT DESCRIPTION

The undertaking description in the final FOE and this FOE Addendum remain the same. Direct and indirect effects under 36 CFR 800.5(a)(2)(i) and (ii) to Doyle Drive, Lincoln Boulevard, the existing bluff grade, and historic trees in the vicinity of Battery Slaughter are addressed in the Final FOE (Federal Highway Administration 2005). In the case of Battery Slaughter, the final FOE stated that construction would not touch any of the PNHLD contributing archaeological feature No. F47 batteries (Federal Highway Administration 2005). Since then, design plans for the northbound Battery Tunnel adjacent to Battery Slaughter have changed, resulting in the possibility that Battery Slaughter may suffer a direct adverse effect under 36 CFR 800.5(a)(2)(i) and (ii). The following provides a general description of design changes for the northbound Battery Tunnel that was not previously anticipated in the final FOE. This description of design changes is general because final design plans for the northbound Battery Tunnel are not yet complete.

The northbound and southbound Battery Tunnels, consisting of shallow cut-and-cover tunnels extending 240 meters (787 feet), will pass between the San Francisco National Cemetery and Battery Slaughter. The Battery Tunnels will connect with the high viaduct to the west and with an open, depressed roadway that will lead to the Main Post to the east. The southbound tunnel structure will be constructed first and will be located beneath a reconstructed Lincoln Boulevard. Once the southbound Battery Tunnel is complete, the northbound Battery Tunnel will be constructed.

Since completion of the original FOE, changes to the precise location of the tunnels have resulted in the movement of the tunnels slightly north of their original designed location. If the southern walls and foundation of Battery Slaughter still exist, construction of the northbound Battery Tunnel will extend north a few feet, past the walls and foundation and into the remaining portion of the battery. It is unknown what method of construction will be used for the northbound Battery Tunnel, but it is reasonable to anticipate that construction of the northbound tunnel would be similar to that of the southbound Battery Tunnel. Therefore, a general description of the methods to be used for the southbound Battery Tunnel is described below as a proxy description of anticipated methods of construction for the northbound Battery Tunnel.

1.6.1 Shoring Methods

Elements of the proposed tunnel construction that would encroach into the battery, if still extant in that area, may include temporary shoring to retain the earth north of the tunnel construction (Figure 2, Section A-A). Soldier piles and tiebacks are elements of a temporary shoring system that may be used during the construction of the tunnel. These elements are necessary to retain the earth north of the tunnel location so that the northbound Battery Tunnel may be constructed.

Steel soldier piles are vertically oriented beams placed in drilled holes prior to excavation and are typically at regular intervals along the length of the tunnel. Pressure-treated timber lagging would span horizontally between the soldier piles to retain the soil as excavation proceeded. The piles are typically 18-inch steel beams set in a drilled hole 30 inches in diameter; the back face of the drilled hole would be located in the northern edge of the tunnel construction area to allow free movement in the construction zone. The soldier piles would be permanent but the top of the piles would be cut and removed below the final grade once the tunnel is completed.

The piles would be braced (propped) at regular locations along their height by steel struts that span the excavation to the wall on the opposite side.

If steel struts are not used, tiebacks may be used in their place. If used, tiebacks would be installed at each soldier pile in rows so that they support the soldier piles. The rows of tiebacks would be placed at a downward angle and would be embedded northward into the earth from the back face of the soldier pile. While tiebacks are permanent in that they will remain in the ground in their stressed condition, they are not needed once the tunnel is completed.

1.6.2 Excavation Methods

The soldier piles and tiebacks would be constructed to retain the soil so that the Battery Tunnel may be constructed. Currently, neither depth of excavation nor excavation methods to be used at this location have been determined. However, it is assumed that the depth of excavation required to emplace the necessary substructures and to construct the tunnel will be well below the foundation of Battery Slaughter.

SECTION 2: BATTERY SLAUGHTER

Battery Slaughter is specifically identified in the 1993 NHL Registration Form update as a contributing feature of the PNHLD, and is listed along with nearby Batteries Baldwin, Sherwood, and Blaney as archeological feature No. F47 (Alley et al. 1993). The character-defining feature of these batteries is their massive concrete construction embedded in earthen mounds, built to withstand the stresses of gun recoils (Federal Highway Administration 2005).

Battery Slaughter was partially buried during the construction of Doyle Drive (1934–1937), and the south side of the battery may have been either partially dismantled or totally removed during the construction of Doyle Drive in the area immediately adjacent to the battery. Currently, only small parts of the battery's parapet and observation station are visible above ground when viewed from Doyle Drive (Figure 3). Recent subsurface testing indicates that portions of the battery extend beneath the sidewalk north of northbound Doyle Drive, but it is unclear if the battery actually extends beneath Doyle Drive. The history of Battery Slaughter, as well as nearby batteries and other historic coastal defense facilities, is discussed in Section 2.1.

2.1 HISTORICAL DEVELOPMENT OF BATTERY SLAUGHTER AND RELATED COASTAL DEFENSE FACILITIES

Battery Slaughter was the largest of four batteries to be developed around 1900 on the coastal bluff between the San Francisco National Cemetery to the south and the U.S. Life Saving Station on the shoreline flats to the north. At that time, the site was part of the northeastern portion of Fort Winfield Scott, situated west of the Presidio's Main Post. The U.S. Army constructed Battery Slaughter and three other nearby batteries at the end of the "Endicott Era," the period of coastal-defense development in the United States named for Secretary of War, William C. Endicott, whom President Grover Cleveland appointed in 1885 (Figure 4, U.S. Army Corps of Engineers 1916, revised). Endicott headed a committee organized to study and submit recommendations for improving the nation's costal defenses. One of the two key results of the Endicott program, implemented largely during the Spanish-American War years around the Presidio, was development of larger, more powerful, and more accurate weaponry. These included eight-inch, 10-inch and 12-inch caliber guns, often mounted on disappearing carriages, the largest of which could fire 1000-pound projectiles seven to eight miles, equaling or surpassing the power of battleship weaponry at that time (Lewis 1993; Thompson 1979).

Army engineers constructed Battery Slaughter in 1898 (Figure 5, U.S. Army Corps of Engineers 1919a). It was the first battery developed on the bluff north of the San Francisco National Cemetery. The unreinforced concrete structure was built to a length of more than 200 feet (east-west). Its width (north-south) was well over 100 feet. The ends and center of the structure consisted of three emplacements bordered and protected at the west, north, and east by parapets. The battery's operational rooms were situated between and slightly south of the three emplacements, with three rooms built between the center and east emplacements, and seven rooms built between the center and west emplacements. Each cluster of operational rooms was divided into upper and lower chambers, with the upper, more heavily reinforced chambers serving as magazines.

Plans indicate that a stairway, additional room, and additional rectangular feature were situated at the center-west portion of the structure's south side. Engineers armed Battery Slaughter with eight-inch guns mounted on disappearing carriages—an important innovation of the Endicott

Era. These were the largest guns mounted at the four batteries to be developed north of the San Francisco National Cemetery (U.S. Army Corps of Engineers 1919a; Thompson 1997).

Construction of additional batteries along the bluff east and west of Battery Slaughter began in 1900. Battery Sherwood, developed for two five-inch non-disappearing rapid-fire guns on pedestal mounts, was completed in 1901 at a location adjacent to and west of Battery Slaughter. That year, Army engineers also completed Battery Baldwin to the west of Battery Sherwood. Baldwin was armed with two 15-pounder, three-inch rapid-fire guns on pillar mounts. In 1902, the Army finished work on a fourth battery in the area, Battery Blaney. Built adjacent to and east of Battery Slaughter, Battery Blaney was eventually armed with four 15-pounder, three-inch rapid-fire guns on pillar mounts (Thompson 1979) (Figure 6, U.S. Army Corps of Engineers 1918).

After the Spanish-American War, additional artillery-related development in the vicinity of Battery Sherwood mainly involved modernization of the weapons targeting or “fire control” system. Prompted by recommendations issued by the Taft Board, organized in 1905 and named for then Secretary of War, William Howard Taft, this effort involved replacing the “vertical triangle” method of targeting with a new “horizontal triangle” or “indirect” system that promised greater firing accuracy. The new system required extensively integrated communications to transmit target-coordinate information between fire control commands, plotters, base-end station personnel, and gunners, as well as to assure communication between fire control stations and central battle commands (Freeman et. al. 1999; Lewis 1993; Smith 2004).

As a result of the fire-control modernization effort, by 1909 the Army engineers had constructed two new buildings to support coastal defense operations at the batteries south of the San Francisco National Cemetery: Switchboard Room No. 3 (later Building No. 670), located midway between Battery Baldwin and the Cavalry Stables west of the Cemetery; and the fire control station of the Second Battle Command, Ninth Fire Command at Fort Winfield Scott. Switchboard No. 3 was concrete-walled with a wood, tar, and gravel roof. Constructed of the same basic materials, the Ninth Fire Command’s fire control station was a three-room building. A 1919 Army Corps of Engineers map depicts the telecommunications cable system that served the coastal defense facilities in the area. The map indicates that a base end station was constructed within 100 feet east and slightly south of Battery Blaney as part of the Taft-Era improvements (Figure 7, U.S. Army Corps of Engineers 1919b).

A reinforced-concrete building with a lookout portal, which appears to be this base end station, is visible in a photograph of the construction of the westernmost portion of the Doyle Drive Low Viaduct (Figure 8, Golden Gate Bridge & Highway District ca. 1934). The main line of the cable system ran underground from the west to Switchboard Room No. 3. From there, the main line extended slightly north and then east along the north side of Lincoln Boulevard. At several points, additional cabling branched north from the main line to Battery Baldwin. Branch cables also extended to Batteries Sherwood and Slaughter via the Ninth Command’s fire control station, and to Battery Blaney via the base end station to the east. At fairly regular intervals along the main cable line and branches, concrete-encased manholes provided access to the underground cables (Biddle 1909; Engineer’s Notebook ca. 1920; Golden Gate Bridge & Highway District ca. 1934; U.S. Army Corps of Engineers 1919b).

Around World War I, technological advances in naval weaponry made extant coastal defenses in the U.S. obsolete. As early as 1916, a number of battleships could outfire all coastal fortifications in the United States. Increasingly, battleships could also fire at higher ranges and greater curvatures, which essentially nullified the advantages of the disappearing carriage that had come to dominate American seacoast defenses. By 1920, Batteries Slaughter, Baldwin, Sherwood, and Blaney had been disarmed (Figure 9, U.S. Army Corps of Engineers 1920). It

appears that the Coastal Artillery Corps may have continued to make use of the magazines at Battery Slaughter for storage purposes into the early 1930s (Lewis 1993; Thompson 1979).

The coastal defense facilities north of the San Francisco National Cemetery were significantly altered with construction of the Golden Gate Bridge by the Golden Gate Bridge and Highway District. The east-west alignment of the bridge's approach road through the Presidio (now known as Doyle Drive) cut through the battery bluff area north of Lincoln Boulevard. A 1936 map of the Doyle Drive alignment indicates that the Ninth Command fire control station was located at the southern side of the alignment and that the building was at least partially or entirely demolished (Figure 10, Strauss Engineering Corporation 1936). Although not indicated on this map, it is also likely that the base end station situated southeast of Battery Blaney, at the approximate location of the west abutment of the Doyle Drive Low Viaduct, was also demolished at this time. The Taft-Era cable system and concrete-encased manholes are extant on this map in the vicinity of the Doyle Drive alignment. Features associated with this system may be buried under Doyle Drive in this area. Switchboard No. 3 (Building No. 670), was not located within the historic Doyle Drive alignment, but the building was recently demolished as part of the current undertaking.

It is possible that the extant Doyle Drive alignment overlaps with the footprint of the original Battery Slaughter and Battery Baldwin sites (Figure 10).The extent to which portions of Batteries Slaughter and Baldwin may remain intact and buried under Doyle Drive, however, is currently unclear. Available fragmentary evidence indicates that at least part of Batteries Slaughter and Baldwin were demolished. In January 1936, during the construction of Doyle Drive, Golden Gate Bridge & Highway District (GGB&HD) Chief Engineer Joseph B. Strauss complained that he had "not yet received authority from Colonel Schulz to demolish Battery Baldwin." Ultimately, Battery Baldwin was only partially demolished and is not expected to be affected by the current undertaking.

On February 10, 1937, Strauss requested approval for "the placing of a small concrete wall at the east end of the High Viaduct in order to keep the fill from slipping into the passageway at Battery Baldwin." That same day, Strauss also reported, "very little work has been done on the graded roadway due to the wet weather. Removal of the old battery concrete is practically completed and they are placing retaining walls and slabs in this area." This is likely a reference not to Battery Baldwin, but rather, to Battery Slaughter, which was the only battery located partially within the alignment of an at-grade segment of Doyle Drive (Battery Lancaster was located within the road alignment at the Toll Plaza area). Some months later, Strauss also reported that "reinforcing steel" had been added "to the pavement at Battery Slaughter" (Golden Gate Bridge & Highway District 1937; Strauss to GGB&HD Board of Directors, January 8, 1936; February 10, 1937; and July 21, 1937).

2.2 EXISTING CONDITION OF BATTERY SLAUGHTER

Battery Slaughter is located on a bluff north of the San Francisco National Cemetery and Doyle Drive. It is the earliest and largest of the batteries the Army built on the bluff (Figure 6).

The existing condition of the battery is difficult to assess: the majority of the southern exposure was buried during the construction of Doyle Drive and the remaining exposed portions of the battery are largely obscured by vegetation (Figure 11). Only about 25% of the 100-by-200-foot structure is now visible. Multi-colored, painted graffiti is present on most visible portions of the battery (Figure 12).

Doyle Drive is parallel to the western half of the south-southwest elevation. Doyle Drive curves northward, affecting the sub-grade concrete rooms shown on battery construction drawings

along the eastern half of the battery's south-southwestern elevation. The condition of these rooms is unknown. The rooms appear to have been altered or demolished during the construction of Doyle Drive.

On the north side of Battery Slaughter, facing the bluff edge and San Francisco Bay and parallel to a road connecting the four batteries, three emplacements are bordered and protected at the west, north, and east by parapets. None of these emplacements are currently visible (Figure 13). Battery Slaughter's eight-inch guns, mounted on disappearing carriages that were protected within the three parapets, are no longer present.

Battery Slaughter is constructed of heavy, unreinforced concrete and posesses beveled surfaces designed to deflect missiles. The most visible portion of the battery is a parapet, set back from and between the central and western emplacements, designed to protect access to the battery. A steel ladder still connects the floor of the parapet, about six feet below the parapet walls, to the top of the parapet (Figure 14). The ladder's rails and rungs are constructed of solid steel rods. Directly in front of the parapet and to the north is a raised manhole positioned above the central, most northerly, and largest chamber of the battery (Figure 11). It is now welded shut and spray painted with graffiti.

The battery's operational rooms were situated between and slightly south of the three emplacements and form wings connecting the northward projecting emplacements. Three rooms were built between the center and east emplacements. The most southerly room projected into the path of the original Doyle Drive construction. Of the seven rooms built between the center and west emplacements, four small chambers projected into Doyle Drive's path.

Each cluster of operational rooms was divided into upper and lower chambers, with the upper, more heavily reinforced chambers serving as magazines. When Doyle Drive was constructed, two sets of sub-grade chambers, five chambers in all, may have been altered (Figure 15). Two reinforced concrete slabs were poured at this interface, approximately at the concrete ceiling level of each set of chambers and directly above the chambers' south-southwestern walls. These slabs are each approximately 15 feet wide from north to south by 100 feet wide from east to west. Exactly how these slabs affect the chambers is not known (Figure 2).

Construction of the original Doyle Drive may have affected these southerly projecting chambers in several possible ways. First, the chambers may have been demolished and the slabs added to lend stability over the fill that replaced the chambers. Second, the chambers may have been affected by construction, planned or unplanned, and the slabs were added as a repair and replacement of the ceiling. In this case, the chambers may have been filled with soil, concrete, or rubble, or there may still be voids. Third, it is possible that the reinforced concrete slabs were placed on and above the southerly wall of the chambers to protect them from damage and to prevent structural failure of the chambers from undermining the stability of Doyle Drive.

2.2.1 Additional Efforts to Identify Existing Condition of Battery Slaughter

The northbound Battery Tunnel will be constructed in very close proximity to Battery Slaughter. Several studies were undertaken by ARUP in 2008 and 2009 to generate more precise information on the limits of the extant Battery Slaughter structure (Appendix B). Specifically, these studies sought to determine if intact portions of Battery Slaughter are located below Doyle Drive or if, as the documentary evidence on the construction of Doyle Drive suggests, the GGB&HD partially or entirely removed those portions of the original battery located within the Doyle Drive alignment during the 1930s.

The studies sought to establish the physical limits of Battery Slaughter using GPS mapping and two phases of investigatory potholing, the second phase of which included the use of ground penetrating radar (GPR). ARUP initially estimated the physical limits of Battery Slaughter in a GIS map by overlaying an as-built drawing of the battery onto an aerial photograph of the exposed portions of the Battery. The superimposed GIS map indicated that portions of Battery Slaughter may be located beneath the adjacent at-grade segment of northbound Doyle Drive (Figure 15). Based on this information, ARUP designed a two-phase investigation to identify the limits of the battery in relation to planned Doyle Drive construction.

The first phase of physical investigation took place in October 2008. Eight survey points were laid out in four sets of two points based on the GIS map overlay. Potholes were dug north of the chain link fence at the north side of Doyle Drive on lines determined by the two-point survey points. At points where the battery structure was encountered, a second corresponding phase of potholing was undertaken along the sidewalk and roadway south of the fence. The resultant soundings indicated that portions of Battery Slaughter remain intact below the ground surface at least as far south as the sidewalk along the north side of the northbound lane of Doyle Drive (Appendix B, Figure 1). A Caltrans archaeologist monitored several of the pothole excavations.

In March of 2009, Geovision, Inc. conducted the second phase of physical investigation, which involved additional potholing and GPR use. The GPR survey indicated the presence of two reinforced concrete slabs beneath the northernmost lane of Doyle Drive. Each slab appears to be 100 feet long and to be centered over portions of the battery structure which, if intact, would extend beneath the roadway (Appendix B, Attachment A: Figure 1). Additional potholing was conducted on the basis of the GPR data. On successive nights during which the two northernmost lanes of Doyle Drive were closed at 12 a.m., Greg Drilling and Testing, Inc. used a vacuum truck to excavate the next series of potholes. These potholes were excavated to a depth of five feet beneath the ground surface at those locations. An archaeologist from ICF International (known then as ICF Jones & Stokes) monitored this phase of potholing.

ARUP determined that the reinforced concrete slab discovered during the GPR survey was not part of the battery structure. Additional potholing was performed to extend the line of the Phase 1 investigation into the Doyle Drive sidewalk and roadway. These potholes were taken to maximum depths of five feet. The resultant soundings indicated that the battery structure extends under the sidewalk within a depth of five feet, but that it is not detectable under the roadway within a depth of five feet. A drainage pipe extends through and below the roadway parallel to and at the edge of the sidewalk toward the east end of the battery, where the concrete slab is encountered only nine inches below the extant sidewalk grade. Evidence and observation indicate that the drainage pipe would likely interfere with the battery structure if it were present.

2.2.2 Combined Evidence from Historic Documentation and Physical Investigation

The totality of evidence from historical documents and recent physical investigation suggests that northerly portions of the original battery structure are not present under the Doyle Drive roadway. The historical evidence from GGB&HD documents indicates that the battery structure was at least partially demolished and altered with concreting during the construction of Doyle Drive in the 1930s. The evidence from recent physical investigations determined Battery Slaughter does not exist within five feet beneath the Doyle Drive roadway. Physical investigations have also revealed the presence of concrete slabs which, in all probability, are the product of the Doyle Drive concreting work described in the GGB&HD documentation.

This totality of evidence, however, *is not conclusive*. The documentary evidence remains fragmentary. It does not specify the extent of demolition and concreting at Battery Slaughter during the construction of Doyle Drive. The recent physical investigations remain inconclusive regarding the potential for portions of the original Battery Slaughter structure to be present under the concrete slabs below the Doyle Drive sidewalk, as well as below the Doyle Drive roadway, at depths exceeding five feet.

SECTION 3: APPLICATION OF CRITERIA OF ADVERSE EFFECT

Under Section 106 of the NHPA, an agency will assess the effects on historic properties in accordance with 36 CFR 800.5 *Assessment of Adverse Effects*.[1] The NHPA defines an effect as an alteration to the characteristics of a historic property that qualify it for inclusion in or eligibility for the NRHP:

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative.[2]

The criteria of adverse effect are applied to all historic properties within the APE, with consideration given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. The criteria of adverse effect are used as a threshold for determining whether a project will have an adverse effect or no adverse effect (i.e. does a project diminish a property's integrity?). In this instance, the entire PNHLD is the historic property consisting of numerous contributing resources (buildings, structures, archaeological sites, etc.).

The integrity assessments for the PNHLD that are used to support the finding of effect in this assessment are presented in Section 3 of this document.

According to 36 CFR 800.5, an adverse effect on a historic property includes, but is not limited to:

i. Physical destruction of *[sic]* damage to all or part of the property

ii. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines

iii. Removal of the property from its historic location

iv. Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance

v. Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features

vi. Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization

[1] 36 CFR 800.4[d][2]

[2] 36 CFR 800.5[a][1]

vii. Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance[3]

3.1 ADVERSE AND CUMULATIVE ADVERSE EFFECTS

A direct effect is one that acts on the physical material of a property, such as demolition, relocation, additions, and deterioration. An indirect effect is one that acts on an intangible element of a property, such as a viewshed, a visual relationship, ownership, or management practices. According to 36 CFR 800.5(a)(1) "adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative."[4] Assessing effects for a particular project depends on evaluating the property's integrity as "the ability of a property to convey its significance." Past projects are considered because a series of actions could gradually erode a property's integrity. An effects assessment, therefore, examines the effects of a project within a broader cumulative context.

3.2 EFFECT ON THE PRESIDIO NATIONAL HISTORIC LANDMARK DISTRICT

It is assumed that the undertaking will have a direct adverse effect on a portion of PNHLD contributing archaeological feature No. F47, which consists of the extant structural remains of Battery Slaughter. It is assumed that this effect will occur to southerly portions of Battery Slaughter which may be currently buried under the two northernmost northbound lanes of the at-grade Doyle Drive roadway at this location. If encountered, those portions of Battery Slaughter that stand to interfere with construction of the new northbound Battery Tunnel will be demolished. The partial demolition of a resource that contributes to the PNHLD would constitute physical destruction and significant alteration of part of the PNHLD (36 CFR 800.5[a][2][j]).

3.2.1 Mitigation Proposed to Treat Adverse Effects

Should tunnel construction result in exposing extant portions of Battery Slaughter, work will stop and the mitigation program will be initiated. Depending on the extent of construction effects, mitigation will be determined by the TOP. Mitigation of the direct adverse effects to Battery Slaughter will consist of one or more of three components: formal recordation in the form of Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) documentation, public interpretation, and graffiti removal. The level of HABS/HAER documentation necessary to partially mitigate effects on Battery Slaughter will be determined by the TOP. Similarly, the type of public interpretation produced and the scope of graffiti removal will also be determined by the TOP.

HABS/HAER Documentation

Under Section 106 of the NHPA, Federal agencies are required to mitigate adverse effects on historic properties (including contributing elements of historic districts) listed in the National Register. When the historic property or a contributing element is a building, structure, or object,

[3] 35 CFR 800.5(a)(2), "Assessment of Adverse Effects" incorporating amendments effective August 5, 2004.

[4] 36 CFR 800.5[a][1]

and the undertaking consists of demolition or substantial alteration, mitigation may take the form of HABS/HAER documentation.

Documentation of historic buildings, structures, or objects, as set forth in the *Secretary of the Interior's Standards and Guidelines for Architectural Engineering Documentation: HABS/HAER Standards (REF–TIM)*, comprises several elements, including measured drawings, large-format photographs, and written data. Each of the products must conform to four standards regarding content, quality, materials, and preservation. Within each standard are varying levels of documentation, each applicable to the nature and significance of the historic property or contributing resource as well as to the reason for documentation. The TOP will determine the level of documentation necessary to record Battery Slaughter.

The HABS/HAER will be completed by and reviewed and approved by a historian, architectural historian or historical architect who is professionally qualified according to the Secretary of the Interior's standards, as well as the TOP, and will follow the Secretary of the Interior's *Guidelines for Architectural and Engineering Documentation.*

Public Interpretation

As stipulated in the BETP (California Department of Transportation 2009a) prepared for the undertaking, public interpretation will be developed and implemented for those built-environment resources that are adversely affected by the undertaking. If Battery Slaughter is encountered during construction, detailed plans for interpretation will be initiated. The primary topic of interpretation will focus on the history and development of the coastal defense system and will focus on the history and use of Battery Slaughter, as well as the effects on Battery Slaughter resulting from construction of the original Doyle Drive and the current Presidio Parkway. The development of public interpretation for Battery Slaughter will be a collaborative process between the undertaking agencies, stakeholders, and interested parties. The interpretation treatment will be consistent with Presidio Trust policies and management plans and with current interpretive plans for the PNHLD. Caltrans and the SFCTA, in conjunction with the TOP, will also take into account the comments and recommendations provided by interested parties.

Graffiti Removal

Graffiti removal will be conducted by a contractor or contractors, as appropriate, with demonstrable experience in working with historic concrete and graffiti removal. The contractor's qualifications will be reviewed by the TOP, as described in the BETP, which includes historic preservation professionals from Caltrans, the Trust, the NPS, and consultants to the SFCTA.

The selected contractor(s) will prepare a written proposal detailing the method by which the graffiti will be removed and the battery surface protected. The work will be conducted at a time determined by the TOP, possibly after construction of the tunnel is completed. Chemical or physical treatments will be undertaken using the gentlest means possible. The work will follow *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (Weeks and Grimmer 1995) and guidelines for graffiti removal developed by the Trust's historic preservation staff. Treatments that cause damage to the battery will not be used.

3.3 CUMULATIVE EFFECTS ON THE PRESIDIO NATIONAL HISTORIC LANDMARK DISTRICT

Cumulative effects on the PNHLD were addressed in the final FOE. The analysis in the final FOE considered the potential for the Presidio Parkway Alternative, in combination with known past, present, and future projects in the area, to adversely affect the PNHLD. The final FOE concluded that the Presidio Parkway Alternative (now known as the preferred alternative or project) would result in an adverse cumulative effect on the PNHLD. In summary, this conclusion found that the alternative would introduce new structural and visual elements into a part of the PNHLD that has already lost historic integrity through the demolition of contributing buildings and structures. The viaducts, tunnels, and at-grade portions of the preferred alternative that would be constructed in the northeast corner of the PNHLD would not resemble the existing Doyle Drive facility in overall location, massing, and scale. Furthermore, the preferred alternative would require the destruction of additional contributing elements. The additional project refinements along Mason Street would result in similar effects.

If construction of the northbound Battery Tunnel results in further partial destruction of the southbound side of Battery Slaughter, this would result in the alteration of a contributing element of the PNHLD. The undertaking, when considered in conjunction with past, present, and future projects, would result in an adverse cumulative effect to the PNHLD (36 CFR 800.5[a][1]). The refinements to the preferred alternative do not alter the conclusions presented in the final FOE.

SECTION 4: CONCLUSION

Refinements to the preferred alternative (Battery Tunnel construction) may cause an adverse effect on the PNHLD in addition to that defined in the FOE and first addendum FOE, specifically Battery Slaughter, a contributing element of the PNHLD. Shoring and construction methods to be used during the construction of the Battery Tunnel may encounter buried portions of Battery Slaughter and, if so, would partially demolish and alter the character-defining features of this resource. If this occurs, mitigation will be completed and may consist of HABS/HAER documentation, public interpretation, and graffiti removal. HABS/HAER documentation will be completed according to the Secretary of the Interior's *Standards and Guidelines for Architectural and Engineering Documentation.* Public interpretation will be developed through a collaborative process facilitated by the TOP and carried out by cultural resources professionals who meet the Secretary of the Interior's professional standards for archaeology, history, or architectural history. Graffiti removal will be completed following the Secretary of the Interior's *Standards and Guidelines for the Treatment of Historic Properties* and will use methods developed by the Presidio Trust. The refinements to the preferred alternative do no alter the conclusions presented in the final FOE.

SECTION 5: REFERENCES

Alley, P., L. Barker, G. Chappell, C. Feierabend, J. P. Langellier, D. Quitevis, and S. A. Dean
1993 *National Register of Historic Places Registration Form*. Presidio of San Francisco National Historic Landmark District. United States Department of the Interior, National Register Programs, National Park Service, Western Regional Office, San Francisco, California.

Biddle, Lieut. Col. John.
1909 Report of Completed Batteries, Etc., Defenses of San Francisco, California. Corps of Engineers, U.S. Army.

California Department of Transportation
2009a *Historic Properties Treatment Plan for Built Environment Resources, South Access to the Golden Gate Bridge Doyle Drive Project, City and County of San Francisco, California*. February. ICF Jones & Stokes, San Francisco, California. ICF J&S 04548.04. Submitted to District 4, California Department of Transportation, Oakland, California, and the San Francisco County Transportation Authority, San Francisco, California.
2009b *Mitigation Implementation Plan, South Access to the Golden Gate Bridge Doyle Drive Project, City and County of San Francisco, California*. June. Submitted to the San Francisco County Transportation Authority, San Francisco, California, and the Federal Highway Administration, Sacramento, California.

Engineer's Notebook.
ca. 1920 Golden Gate NRA Park Archives and Records Center, Vertical Files—Places—S.F. Harbor Defenses. San Francisco, California.

Federal Highway Administration
2005 *Finding of Effect for the South Access to the Golden Gate Bridge Doyle Drive Project, San Francisco, California*. Contract Number 99/00-7. Prepared by JRP Historical Consulting, Jones & Stokes Associates, and Denise Bradley, ASLA for the San Francisco County Transportation Authority. San Francisco, California.
2007 *Addendum to the Finding of Effect for the South Access to the Golden Gate Bridge Doyle Drive Project, San Francisco, California*. First Addendum. Contract Number 99/00-7. Prepared by JRP Historical Consulting, Jones & Stokes Associates, and Denise Bradley, ASLA for the San Francisco County Transportation Authority. San Francisco, California.

Freeman, Joe C., Stephen A. Haller, David M. Hansen, John A. Martini, Karen J. Weitze.
1999 *Seacoast Fortifications Preservation Manual*. July. National Park Service and KEA Environmental, Golden Gate National Recreation Area, San Francisco, California.

Golden Gate Bridge & Highway District
ca.1934 Photo No. 3, Viaduct, Low Presidio Approach, 1905.14282, Construction Photographs of the Golden Gate Bridge, 1933-34, Bancroft Library, University of California, Berkeley, available at the On-line Archive of California: <http://www.oac.cdlib.org/ark:/13030/tf4b69p06s/?brand=oac4>. Accessed December 28, 2009.
1937 Minutes of the Meeting of the GGB&HD, February 10, 1937, Book 3:443, Historic Records of the Golden Gate Bridge Highway & Transportation District, San Francisco, California.

ICF Jones & Stokes

2009 *Archaeological Treatment Plan for the South Access to the Golden Gate Bridge Doyle Drive Project, City and County of San Francisco, California*. April. ICF Jones & Stokes, San Francisco, California. ICF J&S 04548.04. Submitted to District 4, California Department of Transportation, Oakland, California, and the San Francisco County Transportation Authority, San Francisco, California.

Jones & Stokes and Albion Environmental, Inc.
2002 *Final Archaeological Survey Report/Historical Survey Report for the Doyle Drive Corridor Project, Presidio of San Francisco National Historic Landmark District, City of County of San Francisco, Volume 2 of 4.* Prepared for Parsons Brinckerhoff and the San Francisco County Transportation Authority. San Francisco, California.

Lewis, Emanuel Raymond.
1993 *Seacoast Fortifications of the United States: An Introductory History.* Naval Institute Press: Annapolis, Maryland.

Smith, Bolling W.
2004 Fire Control and Position Finding: Background. In Mark A Berhow, ed., *American Seacoast Defenses, A Reference Guide*. CDSG Press: McLean, Virginia.

Strauss Engineering Corporation.
1936 Presidio Road—Location of Structures and Obstructions. Sheet No. F-2, May 11, 1936. Golden Gate Bridge at San Francisco, Cal., for the Golden Gate Bridge & Highway District of California. Drawer 365, Folder 2, Golden Gate NRA Archives, San Francisco, California.

Strauss, Joseph B.
1936 Chief Engineer's Monthly Report No. 35 to GGB&HD Board of Directors, January 8, 1936: 1, Charles Derleth Papers, BANC MSS 91/116C, Carton 2, Folder 22, Volume 29, Jan–Apr 1936. Bancroft Library, University of California, Berkeley.
1937 Chief Engineer's Monthly Report No. 48 to GGB&HD Board of Directors, February 10, 1937:1, Charles Derleth Papers, BANC 91/116c Carton 3, Folder 2: Golden Gate Bridge, Vol. 34, Feb.–Apr. 1937. Bancroft Library, University of California, Berkeley.
1937 Chief Engineer's Interim Report to the GGB&HD Board of Directors, July 21, 1937. Charles Derleth Papers, BANC 91/116c Carton 3, Folder 4: Golden Gate Bridge, Vol. 36, July–Sept., 1937. Bancroft Library, University of California, Berkeley.

Thompson, Erwin N.
1979 *Historic Resource Study, Seacoast Fortifications, San Francisco Harbor, Golden Gate National Recreation Area, California.* July. Denver Service Center Historic Preservation Team, National Park Service, United States Department of the Interior.
1997 *Defender of the Gate: The Presidio of San Francisco, A History from 1846 to 1995, Vol. 2.* U.S. Department of the Interior, National Park Service, Golden Gate National Recreation Area, San Francisco, California.

U.S. Army Corps of Engineers, U.S. Army.
1916 (Batteries Map) San Francisco Harbor, Fort Winfield Scott, Eastern Portion (revised 1916). Serial 124, Seacoast Fortifications Maps, GOGA 2261 F1. Golden Gate NRA Archives, San Francisco, California.
1918 Fort Winfield Scott and Presidio of San Francisco (with Batteries and Communications System Overlay). File 7, Sheet 19 (Unclassified December 5, 1963. Golden Gate NRA Archives, San Francisco, California.

1919a Plan of Completed Works—Seacoast Fortifications, Fort Winfield Scott, Battery Slaughter (corrected to December, 1919). Reports of the Completed Works—Seacoast Fortifications, GOGA 2261. Golden Gate NRA Park Archives, San Francisco, California.

1919b Communications Cable System, Fort Winfield Scott, Cal. Drawer 271, Folder 1, Golden Gate NRA Park Archives, San Francisco, California.

1920 Report of Completed Works—Seacoast Fortifications: Battery Slaughter (corrected to March 1, 1920). Reports of the Completed Works—Seacoast Fortifications, GOGA 2261. Golden Gate NRA Park Archives, San Francisco, California.

Weeks, K.D. and A.E. Grimmer

1995 *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings.* Washington, D.C.: NPS, 1995. Published online and available at <http://www.nps.gov/history/hps/tps/download/standards_guidelines.pdf>. Accessed: August 13, 2010.

APPENDIX A: FIGURES 1–15

Figure 1	Area of Potential Effects
Figure 2	Battery Slaughter and Northbound Battery Tunnel
Figure 3	Battery Slaughter and Northbound Doyle Drive, as Viewed from Lincoln Boulevard
Figure 4	1916 Map of the Coastal Bluff Batteries Baldwin, Sherwood, Slaughter, and Blaney
Figure 5	Plan and Elevation Views of Battery Slaughter
Figure 6	1918 Map of the Coastal Bluff Batteries
Figure 7	Coastal Batteries and Associated Communications System, 1919
Figure 8	Base End Station (upper right) During Construction of Doyle Drive, ca. 1934
Figure 9	1920 Army Information Sheet Noting the Disarming of Battery Slaughter
Figure 10	1936 Doyle Drive Construction Plans: Locations of Structures and Obstructions
Figure 11	Vegetation Obscuring Battery Slaughter, Camera Facing the San Francisco National Cemetery
Figure 12	Graffiti on Battery Slaughter Visible from Doyle Drive
Figure 13	Northwestern Emplacement of Battery Slaughter, Buried and Obscured by Vegetation
Figure 14	Battery Slaughter: Visible Parapet and Ladder
Figure 15	Original Plans of Battery Slaughter, Superimposed on Plan of Northbound Battery Tunnel

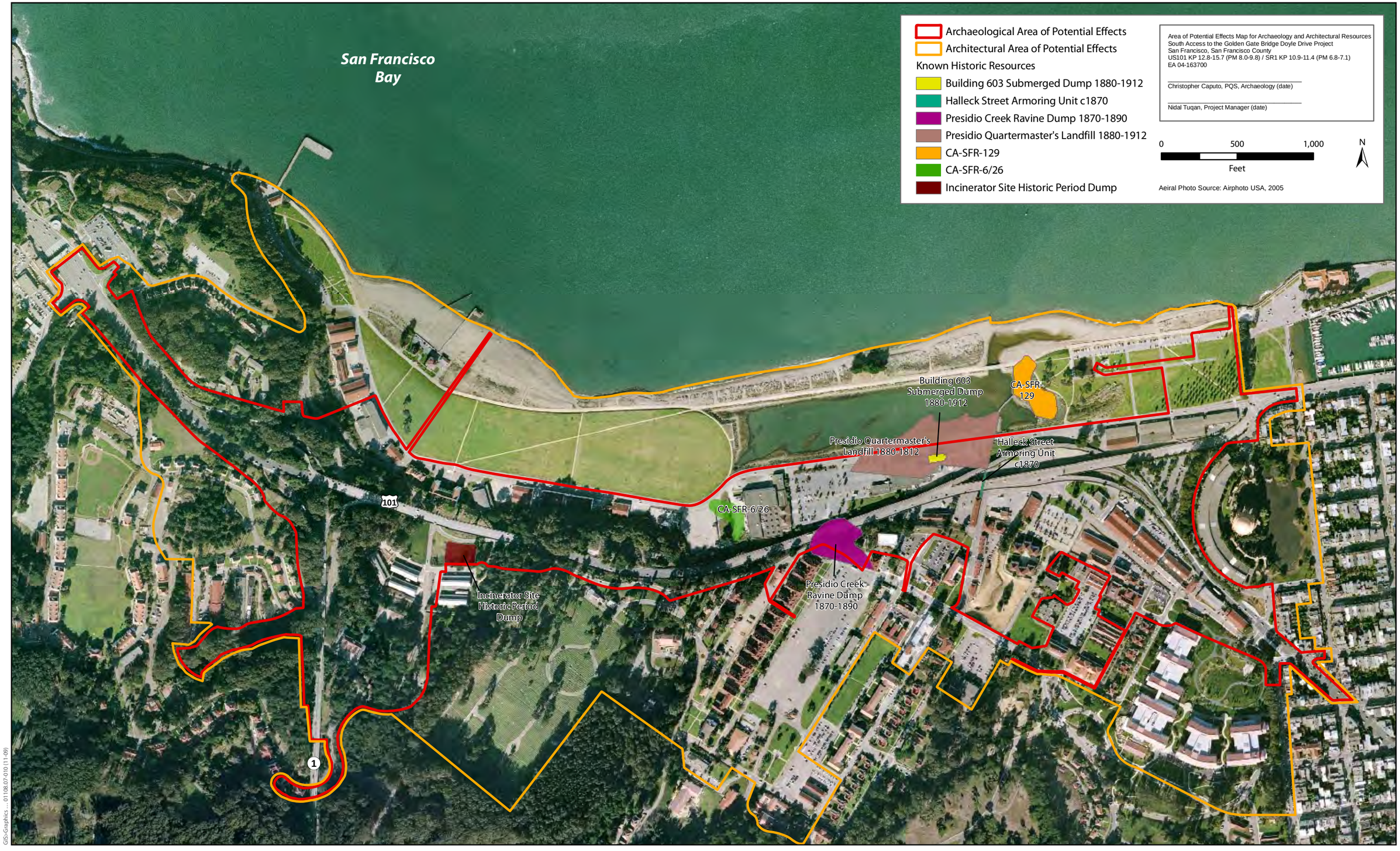
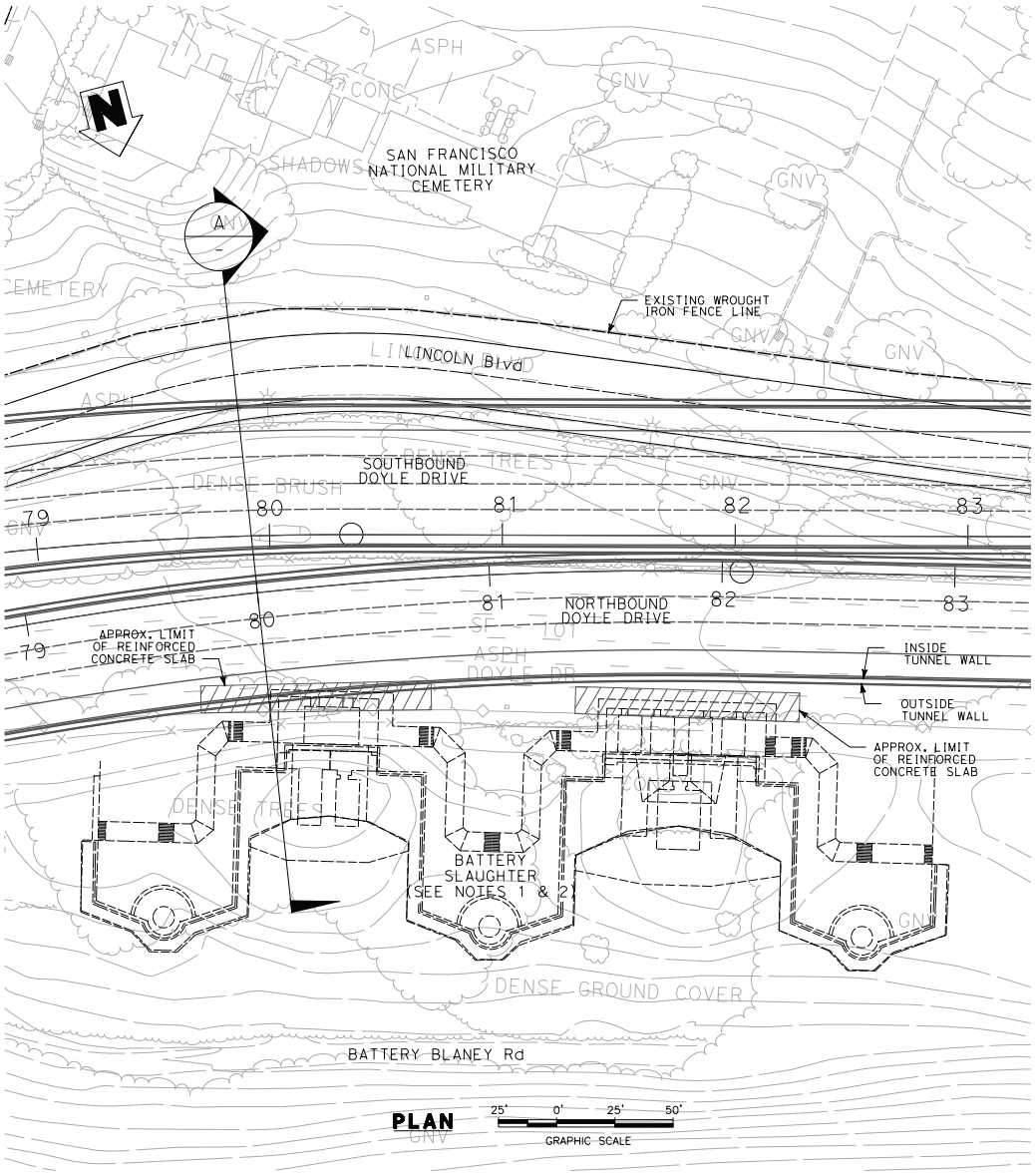
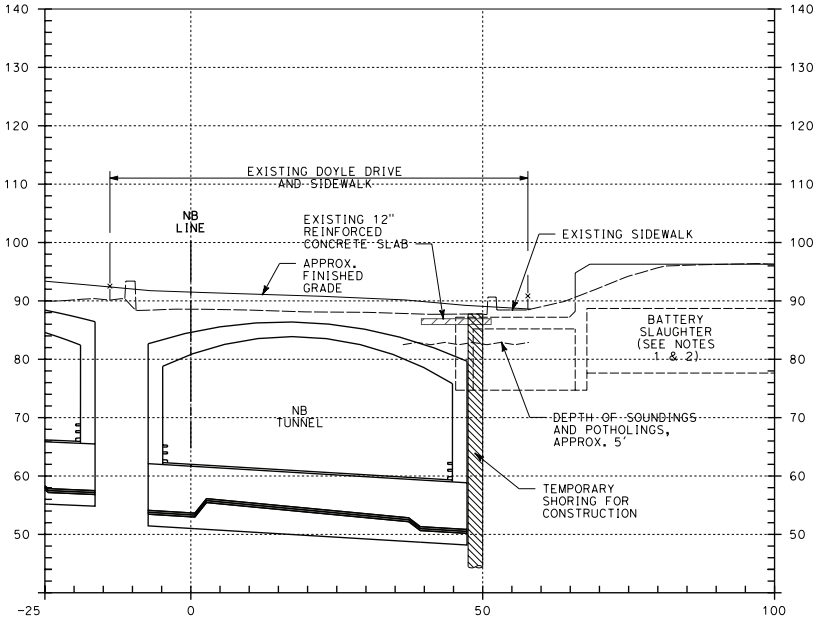


Figure 1
Area of Potential Effects





NOTES

1. EXTENT OF BATTERY SLAUGHTER IS APPROXIMATE.
2. INFORMATION ON BATTERY SLAUGHTER IS FROM ORIGINAL BLUE PRINTS DATED DECEMBER 1919.

DOYLE DRIVE REPLACEMENT PROJECT

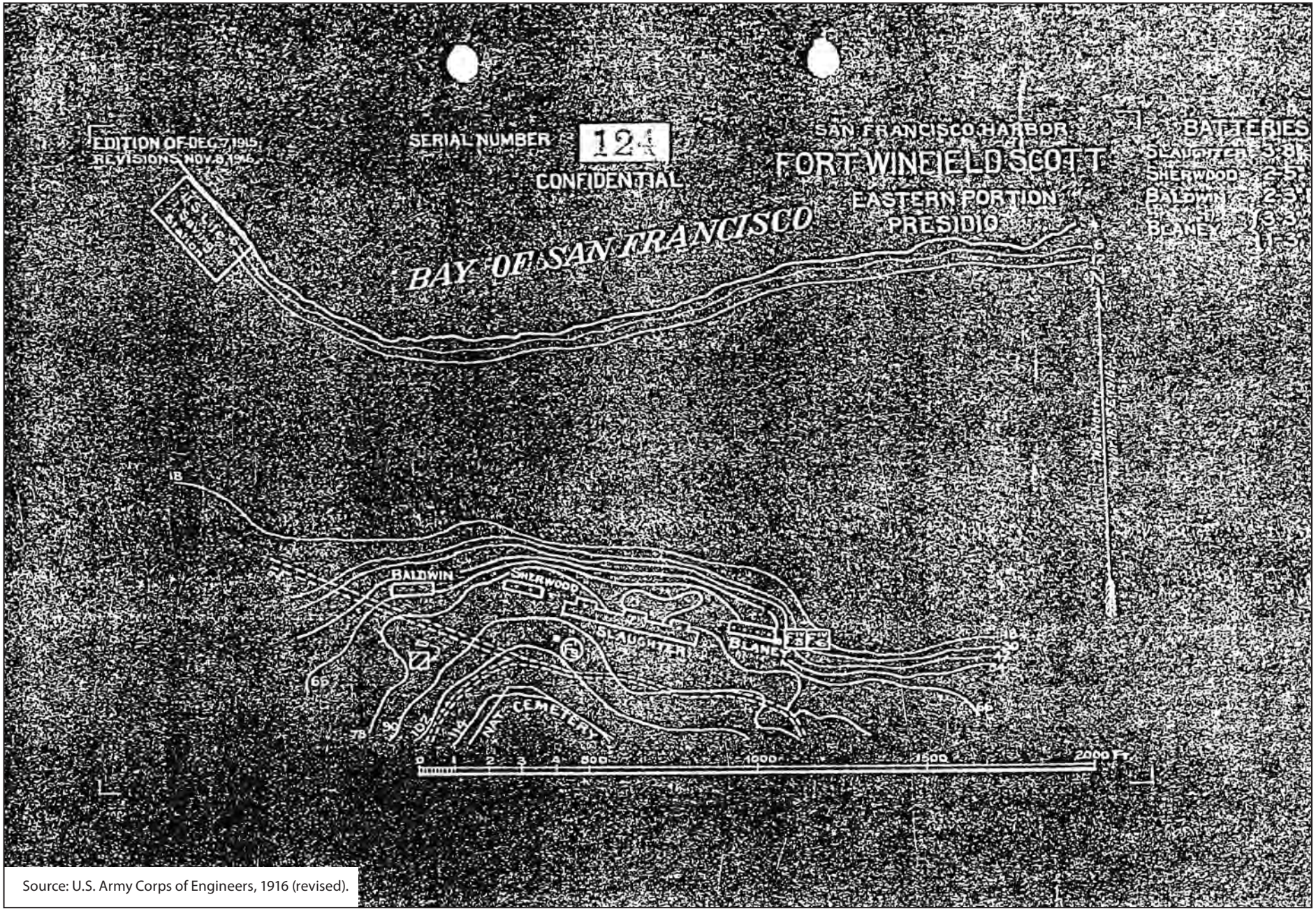
BATTERY SLAUGHTER AND NORTHBOUND BATTERY TUNNEL EXHIBIT

DATE: 21 October 2009

Source: ARUP, 2009.

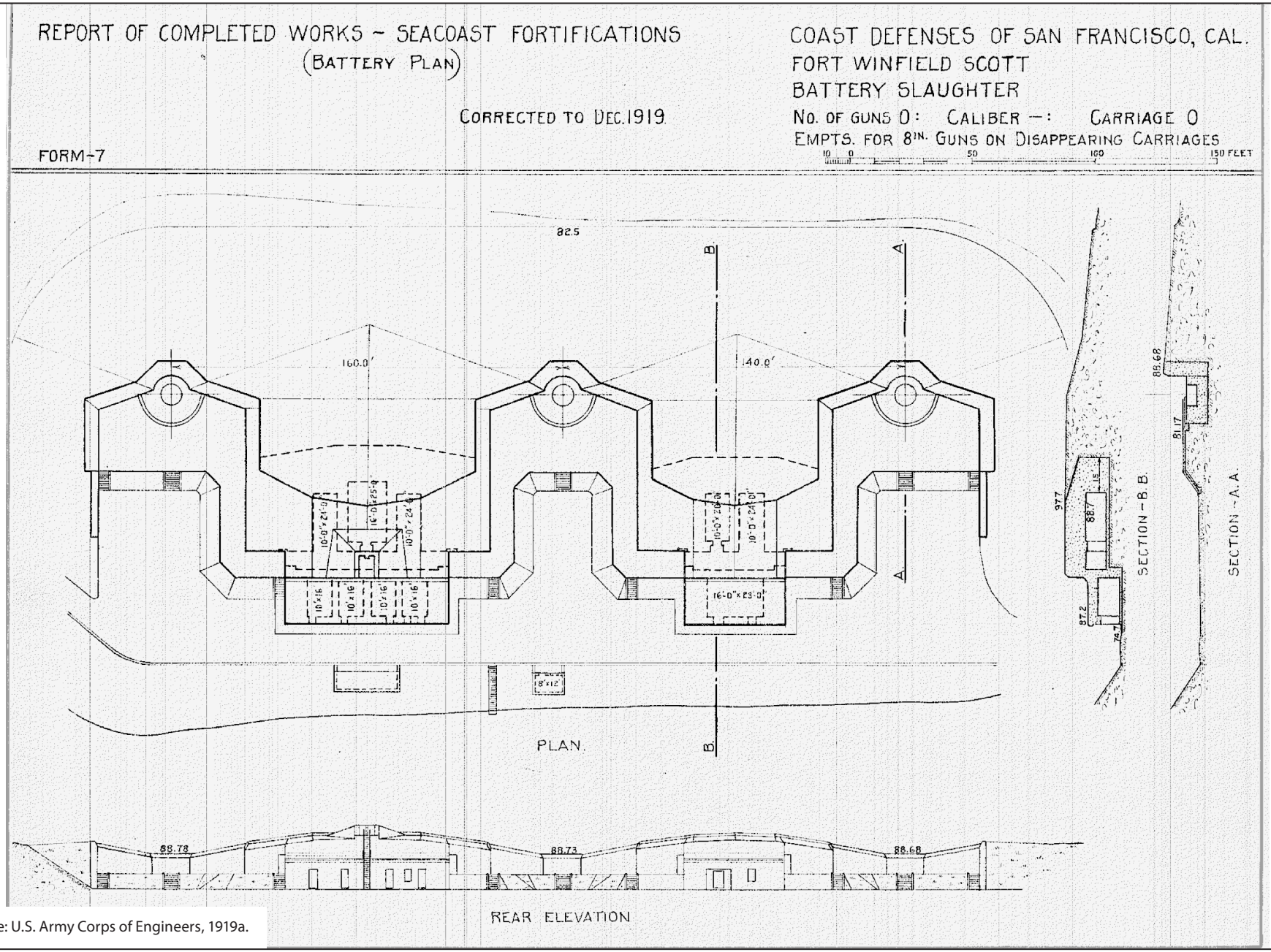
Figure 2
Battery Slaughter and Northbound Battery Tunnel

Figure 3
Battery Slaughter and Northbound Doyle Drive, as Viewed from Lincoln Boulevard (camera facing northwest)



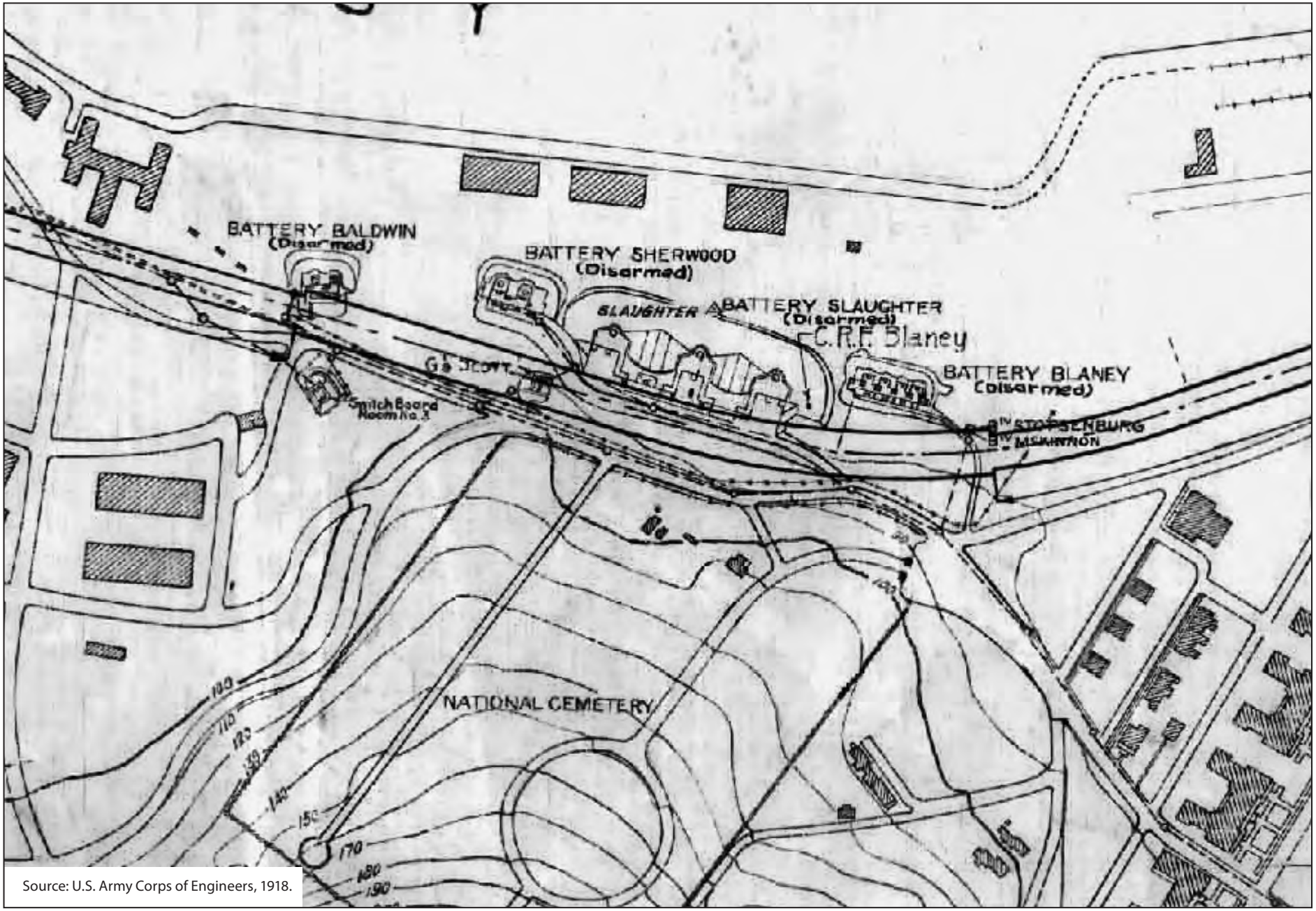
Source: U.S. Army Corps of Engineers, 1916 (revised).

Figure 4
1916 Map of the Coastal Bluff Batteries Baldwin, Sherwood, Slaughter, and Blaney



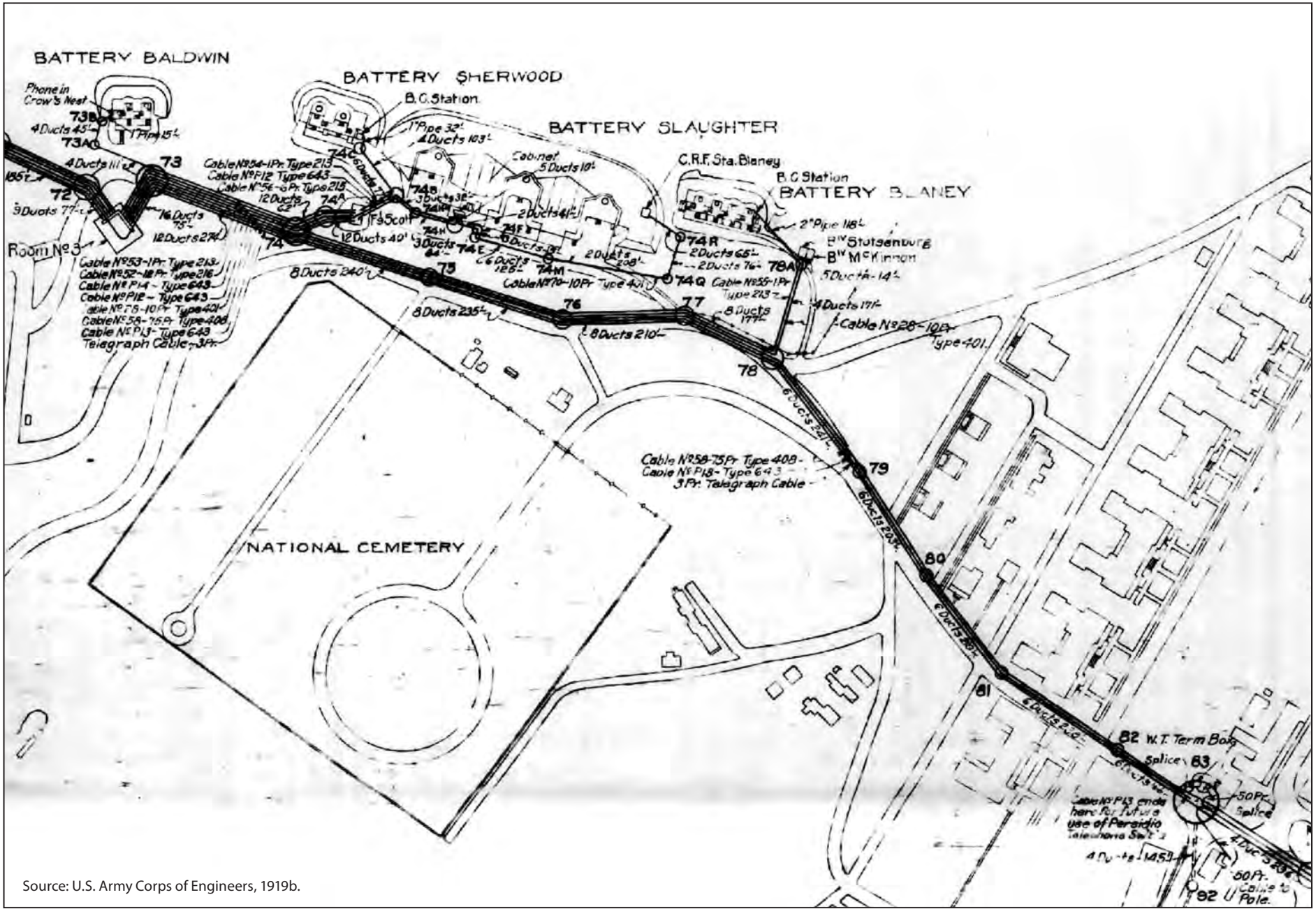
Source: U.S. Army Corps of Engineers, 1919a.

Figure 5
Plan and Elevation Views of Battery Slaughter



Source: U.S. Army Corps of Engineers, 1918.

Figure 6
1918 Map of the Coastal Bluff Batteries



Source: U.S. Army Corps of Engineers, 1919b.

Figure 7
Coastal Batteries and Associated Communications System, 1919

Source: Golden Gate Bridge & Highway District, ca. 1934.

Figure 8
Base End Station (upper right) During Construction of Doyle Drive, ca. 1934

REPORT OF COMPLETED WORKS -- SEACOAST FORTIFICATIONS
(Gun and Mortar Batteries)

Form 1 Corrected to MARCH 1, 1920

COAST DEFENSES OF SAN FRANCISCO, CAL.
FORT WINFIELD SCOTT, CALIF.
BATTERY SLAUGHTER.
No. of guns 0 Caliber 0 Carriage Dis.L.F.

Battery commenced	1899	Source of electric current	Central Power Plant: Two 100-k.w. steam driven sets.
Battery completed	1900		
Date of transfer	Jan. 25, 1900.	Max. kw. required for lights	5.0 k.w.
Material of construction	Concrete.	Max. kw. required for motors	No motors.
Portland or Rosendale cement	Portland.		
Cost to date of transfer	$71,062.65		
Connected to water supply	Yes	Present condition of battery	Good.
Connected to sewer	Yes	Rooms wet or dry	Dry
Type of latrine	Syphon		
Type of data transmission	Telephone.	How ventilated	Natural draft. 30" x 30" concrete shafts with hinged cast iron cover, from magazines.
~~Trunnion~~ Elevation intr.crest of battery	20.7	Remarks-	
Datum plane	M.L.L.W.		

ARMAMENT.

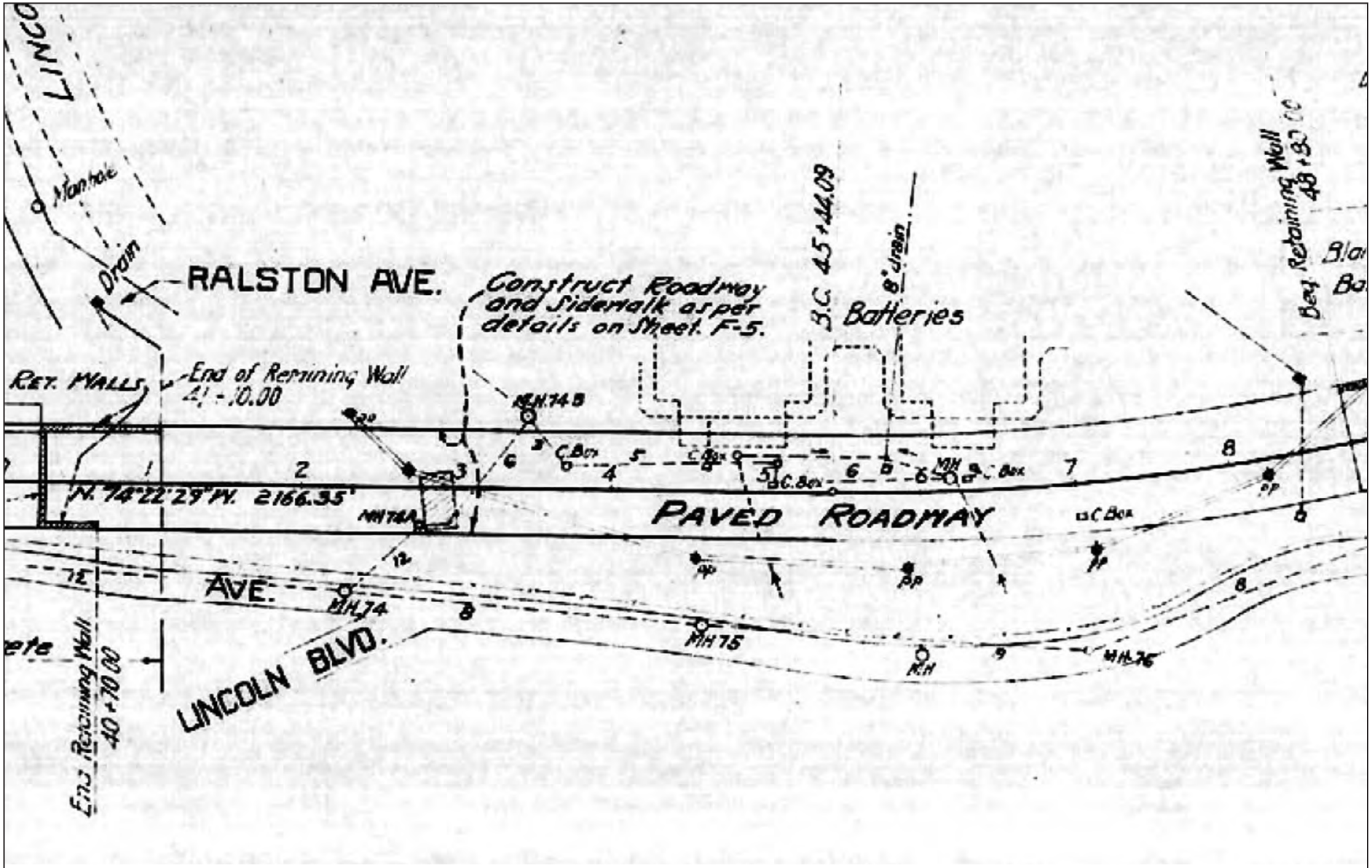
Emplacement or mortar No.	Guns ~~or Mortars~~ Cal.	length	model	Serial No.	Manufacturer	mounted	Carriages Type	model	Serial No.	Manufacturer	Motor
1	GUNS AND CARRIAGES REMOVED 1917.										
2											
3											
4											
5											
6											
7											
8											

HOISTS.

Emplacement Number	Type	Delivery	Motor Serial No.	Maker	H.P.	Volts	RPM	Type of Control	Date of transfer	Remodeled for long points.
1	NO HOISTS REQUIRED.									
2										
3										
4										

Source: U.S. Army Corps of Engineers, 1920.

Figure 9
1920 Army Information Sheet Noting the Disarming of Battery Slaughter



Source: Strauss Engineering Corporation, 1936.

Figure 10
1936 Doyle Drive Construction Plans: Locations of Structures and Obstructions

Figure 11
Vegetation Obscuring Battery Slaughter,
Camera Facing the San Francisco National Cemetery

Figure 12
Graffiti on Battery Slaughter Visible from Doyle Drive

Figure 13
Northwestern Emplacement of Battery Slaughter, Buried and Obscured by Vegetation

Figure 14
Battery Slaughter: Visible Parapet and Ladder

Source: ARUP, 2009.

Figure 15
Original Plan of Battery Slaughter, Superimposed on Plan of Northbound Battery Tunnel

APPENDIX B: FIELD INVESTIGATION TO CONFIRM UNDERGROUND LOCATION OF BATTERY SLAUGHTER

PROJECT MEMORANDUM

Doyle Drive Replacement Project

Date: June 23, 2009

To: John Karn, Arup PB Joint Venture Project Manager
Frank Greguras, Geotechnical Task Manager for Arup PB Joint Venture

From Terrence Carroll, Arup PB

Subject: Field Investigation to Confirm Underground Location of Battery Slaughter

Background and Purpose

This memorandum summarizes the finding of the field work to investigate the limits of Battery Slaughter for the Doyle Drive Replacement Project.

Previously, the location of Battery Slaughter was estimated from a GIS map by overlaying an as-built drawing onto an aerial photograph of the exposed portions of the Battery. The superimposed GIS map indicated that portions of Battery Slaughter may be located beneath the adjacent at-grade section of Doyle Drive. The purpose of the field work was to determine if portions of the Battery structure are located below the ground surface or if they were removed during the construction of Doyle Drive in the 1930's. The limits of the structure were confirmed by digging a series of potholes.

From the GIS map, the assumed limits of the structure were determined. Eight survey points were located in the field by Chaudhary & Associates, Inc. on October 16, 2008 and marked by either PK-nail or lathe. The survey points were laid out in four sets of two, with each set in line with the estimated buried portions of the structure as shown on the attached Figure 1. The surveyed locations were labeled 40000 through 40007.

The first phase of the investigation involved digging potholes off the roadway, north of a chain link fence. If the Battery structure was encountered off the roadway, then a second phase of the work would occur to investigate in the sidewalk and roadway south of the fence-line.

Phase I - Investigation

On October 27, 2008, eight locations were potholed as shown on Figure 1 and labeled Sounding 1 through Sounding 8 (S1 through S8). The soundings were typically located just east or just west of the line formed by the surveyed locations, with one sounding located inside where the buried structure shows on the map, and the other located outside the presumed limits of the Battery. The potholes were excavated using hand augers until either the buried structure was encountered or the hole was deep enough to be confident the structure was not present at

that location. A representative from Caltrans Archaeology (Christopher Caputo) was onsite to observe several of the soundings. Hand auguring adjacent to points 40002 and 40003 was not possible due to heavy brush. As a result, Sounding 5 was moved approximately 25 feet west to avoid the brush.

After completion of all soundings, the holes were backfilled with the cuttings and marked with a wooden lathe.

Table 1, attached, summarizes the findings in each of the soundings. Concrete was encountered in Soundings 1,3,5,6,and 7 indicating that portions of Battery Slaughter remain intact below the ground surface at least as far south as the sidewalk along the northbound lane of Doyle Drive.

Phase II – Investigation

Because portions of the structure were encountered during Phase I potholing, a second phase was undertaken to determine if the structure extends below the sidewalk and existing roadway. On March 21 and March 22, 2009 at 12:00 am, the two northernmost lanes of northbound Doyle Drive (Lanes 2 and 3) were closed so that investigations could be performed in the roadway.

In an attempt to define the limits of the buried structure prior to potholing, GeoVision Inc. performed Ground Penetrating Radar (GPR) on the roadway. The GPR indicated the presence of 2 reinforced concrete slabs in the northernmost lane. Each of the slabs is 100 feet long and is centered over the portions of the Battery structure that would extend into the roadway. The limits of the two reinforced slabs are shown on Figure 1. GeoVision's report is attached in Appendix A.

After the GPR survey was completed, potholing was performed. Because work inside the roadway was constrained by limited work hours, the potholing was performed using a vacuum truck to increase the speed of the excavating. Gregg Drilling and Testing Inc. performed the vacuum excavating. Prior to vacuum excavation, the roadway locations were first cored by Del Secco Diamond Core and Saw Inc. The potholes were excavated until either the buried structure was encountered or the hole was deep enough to be confident the structure was not present at that location (typically 5 feet below the existing grade). An archaeologist from Jones & Stokes was onsite to observe the soundings.

Initially, potholes were excavated at the limits of the reinforced slab found with the GPR survey to determine if the reinforced slab was part of the Battery structure. Six potholes were excavated at the limits of the easternmost reinforced slab (B1 through B6) as shown on Figure 1. Three locations were excavated at both the southeast and southwest corners of the detected slab. The six potholes did not encounter any buried structure within 5 feet of the ground surface. Table 2 presents a summary of the findings in each of the potholes.

After determining that the reinforced slab discovered in the GPR survey was not part of the Battery structure, 14 additional locations (labeled B7 through B20 on Figure 1) were potholed in the sidewalk and roadway. The soundings were typically located just east or just west of the presumed limits of the buried structure and served to extend the line of potholes from the Phase I investigation into the sidewalk and roadway.

The soundings indicate that the Battery structure extends below the sidewalk, but is not located within the roadway. All soundings in the roadway were advanced to approximately 5 feet without encountering the structure. A solid concrete structure was encountered in sidewalk soundings B10, B13, B16, B19, and B20 and was not encountered in the remaining sidewalk soundings. Where encountered below the sidewalk, the Battery structure is located within the limits expected by the GIS map overlayment.

A drainage pipe is located in the roadway, adjacent and parallel to the edge of the sidewalk. The drainage pipe extends down below the roadway grade. At the east end of the Battery, where the structure is encountered only 9 inches below the existing grade (Sounding B9), the drainage pipe would interfere with the Battery structure if it was present. The location of the drainage pipe serves as further confirmation that the Battery structure is not located within the roadway.

After completion of the soundings, the holes were backfilled with cement grout. Soundings in the roadway were topped with rapid-set concrete.

Conclusions

The field work to determine the limits of the Battery Slaughter structure indicate that the structure is not intact below the existing Doyle Drive roadway. However, the roof extension of the Battery structure appears to be intact below the sidewalk as well as north of the fence line and where it is visible above ground.

The presence of the reinforced roadway slab over where the Battery structure was originally located indicates that the roadway design was altered because of the Battery structure. Therefore, while the potholing investigation indicates that the structure is not intact at its original position, it is possible that portions of the structure do remain below the existing Doyle Drive. Based on the location of the drainage pipe and the elevations where the structure was encountered within the sidewalk, the roof extension of Battery Slaughter appears to have been cut near the line of the roadway to allow for construction of Doyle Drive.

It is unknown if the lower walls and other ancillary portions of Battery Slaughter may be encountered during the excavation for the Northbound Battery Tunnel. Based on the construction practices of the time when Doyle Drive was constructed, it should be expected that if portions of the Battery structure are encountered, they may be backfilled with poorly compacted soils and/or demolished completely.

TABLES

TABLE 1
Summary of Soundings at Battery Slaughter

Sounding	Location	Elevation of Ground Surface, NAVD88 (ft)	Elevation of Ground Surface after Clearing Leaves/Brush (Top of Soil), NAVD88 (ft)	Depth Augered (ft)	Buried Structure Encountered?	Comments
1	3.5 ft. NW 40006, 9.2 ft. NW 40007	88.83	87.95	1.2	Yes	Concrete encountered at Elev. 86.75. A larger hole was dug exposing a 1ft x 1ft section of the concrete. The concrete was probed and did not sound hollow.
2	4.1 ft. NE 40006, 9.7 ft. NE 40007	88.80	87.72	4.2	No	The structure was not encountered after augering to Elev. 83.52 ft. Sounding is located outside estimated limits of Battery
3	3.0 ft. NE 40004, 8.3 ft. NE 40005	89.94	88.53	1.6	Yes	Concrete encountered at Elev. 86.93. A larger hole was dug exposing a 0.5ft x 0.5ft section of the concrete. The concrete was probed and did not sound hollow. A thin layer (<0.1 ft) of ash/charred wood was observed immediately above the concrete.
4	4.5 ft. NW 40004, 9.3 ft. NW 40005	90.06	88.44	3.8	No	The structure was not encountered after augering to Elev. 84.64 ft. Sounding is located outside estimated limits of Battery
5	23.1 ft. NW 40002, 25.0 ft. NW 40003	90.51	90.01	2.7	Yes	Concrete encountered at Elev. 87.31. A thin layer (<0.1 ft) of ash/charred wood was observed immediately above the concrete.
6	5.6 ft. NE 40001, 10.4 ft. NE 40000	91.69	90.15	3.0	Yes	Concrete encountered at Elev. 87.19. A thin layer (<0.1 ft) of ash/charred wood was observed immediately above the concrete.
7	3.4 ft. NW 40001, 8.6 ft. NW 40000	91.68	91.10	3.9	Yes	Concrete encountered at Elev. 87.22. A thin layer (<0.1 ft) of ash/charred wood was observed immediately above the concrete.
8	9.2 ft. NW 40001, 14.2 ft. NW 40000	92.13	91.63	5.6	No	The structure was not encountered after augering to Elev. 86.03 ft. Sounding is located outside estimated limits of Battery

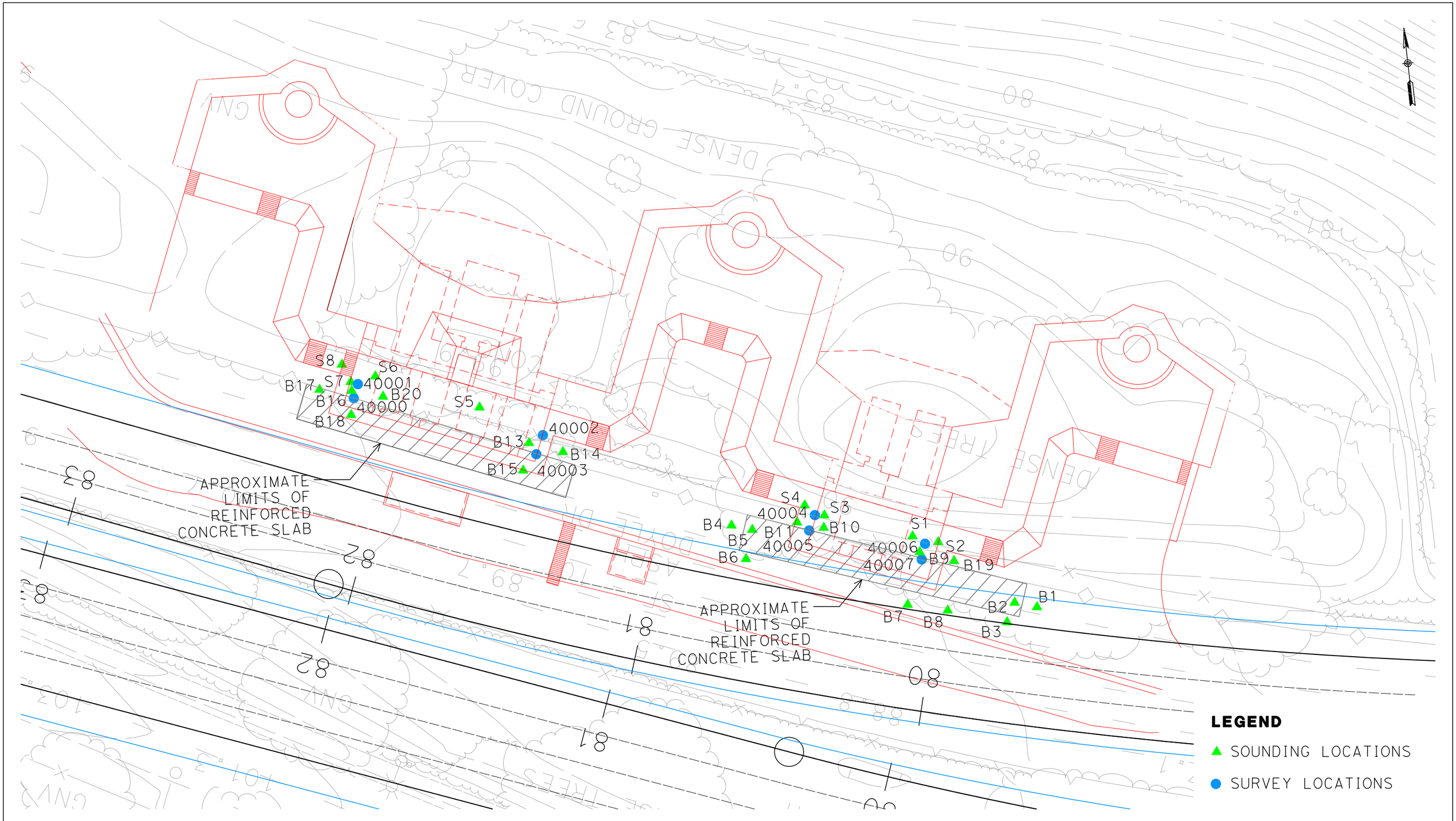
Notes:
1) Elevations were determined using a hand level and and adjacent surveyed locations (40000 through 40007)

TABLE 2
Summary of Soundings at Battery Slaughter - Phase II

Sounding	Location	Depth Augered (ft)	Buried Structure Encountered?	Comments
B1	Outside Reinforced Slab in Lane 3	5.5 feet	No	
B2	Inside Reinforced Slab in Lane 3	5 feet	No	
B3	Inside end of Reinforced Slab in Lane 2	4 feet	No	
B4	Outside Reinforced Slab in Lane 3	0.0	-	Location cored, but not excavated because it is outside the limits of the Battery Structure
B5	Inside Reinforced Slab in Lane 3	0.0	-	Location cored, but not excavated because it is outside the limits of the Battery Structure
B6	Inside end of Reinforced Slab in Lane 2	0.0	-	Location cored, but not excavated because it is outside the limits of the Battery Structure
B7	Inside Limits of Battery Structure in Lane 2	4 feet	No	Six inch diameter abandoned cast iron pipe encountered in hole at 4 feet
B8	Outside Limits of Battery Structure in Lane 2	5.1 feet	No	
B9	Inside Limits of Battery Structure in Sidewalk	9 inches	Yes	Flat concrete slab encountered.
B10	Inside Limits of Battery Structure in Sidewalk	1.4 feet	Yes	Flat concrete slab encountered.
B11	Outside Limits of Battery Structure in Sidewalk	3.3 feet	No	Large boulder obstructing hole at 3.3 feet. The hole depth is below the "expected" depth of the structure so excavation was stopped.
B12	Inside Limits of Battery Structure in Lane 2	4.6 feet	No	
B13	Inside Limits of Battery Structure in Sidewalk	2.4 feet	Yes	Flat concrete slab encountered. When probed, it had a "solid" sound.
B14	Outside Limits of Battery Structure in Sidewalk	5.2 feet	No	
B15	Inside Limits of Battery Structure in Lane 2	5.1 feet	No	
B16	Inside Limits of Battery Structure in Sidewalk	3.2 feet	Yes	Flat concrete slab encountered. When probed, it had a hollow sound.
B17	Outside Limits of Battery Structure in Sidewalk	5.5 feet	No	
B18	Inside Limits of Battery Structure in Lane 2	5.7 feet	No	
B19	Outside Limits of Battery Structure in Sidewalk	5.0 feet	No	
B20	Inside Limits of Battery Structure in Sidewalk	3.2 feet	Yes	Flat concrete slab encountered. When probed, it had a "solid" sound.

Notes:
1) Phase II soundings were not surveyed because they are located in an active roadway.

FIGURES



ARUP PB joint venture

DOYLE DRIVE REPLACEMENT PROJECT

Figure 1: Survey and Sounding Locations at Battery Slaughter

0 15 30
FEET

DATE: 2009 05 26

APPENDIX A

May 22, 2009
Project Number 9101

Terrence Carroll
ARUP
560 Mission Street, Suite 700
San Francisco, CA 94105

Subject: Ground Penetrating Radar (GPR) Report Battery Structure, Doyle Drive Presidio, California.

Dear Mr. Carroll:

A GPR survey was conducted from the 20th to 21st of March 2009 on portions of the Battery Structure in Doyle Drive Presidio, California. The purpose of the investigation was to identify the lateral extent of the steel reinforced concrete pad associated with the Battery Structure in Doyle Drive.

METHODOLOGY

GPR equipment consisted of a Geophysical Survey Systems Inc. (GSSI) SIR-10B GPR system with a 400MHz antenna and survey wheel attachment. Details on the GPR method can be found in the attached technical note titled "Ground Penetrating Radar Methods."

FIELD PROCEDURES

GPR data were acquired semi-continuously as a 400MHz antenna was hand-towed along parallel and perpendicular traverses in the area of investigation as shown in Figure 1. The survey wheel was used to regulate the scan rate and distance. GPR data were viewed in real time on the SIR-10B's color monitor, and saved to the SIR-10B's hard disk. GPR file names along with line number, station range and acquisition parameters were recorded in field notes. All field copies of GPR data are retained in the project files.

DATA PROCESSING

GPR data were downloaded from the SIR10B hard disk to a computer after completion of the field investigation. Data were processed using GSSI's Radan V6.0. Steps applied to the GPR data included:

- Range Gain (dB) 0, 37
- Vertical IIR LP N =2 F =1000 MHz
- Vertical IIR HP N =2 F =20 MHz
- Time Zero Adjustment (Threshold 3000)
- Background Removal
- Kirchhoff Migration Width 63
- Velocity 4.37 in/nanosecond
- Range Gain (L) 4.0

All processed GPR data files were archived on CD-ROM.

RESULTS

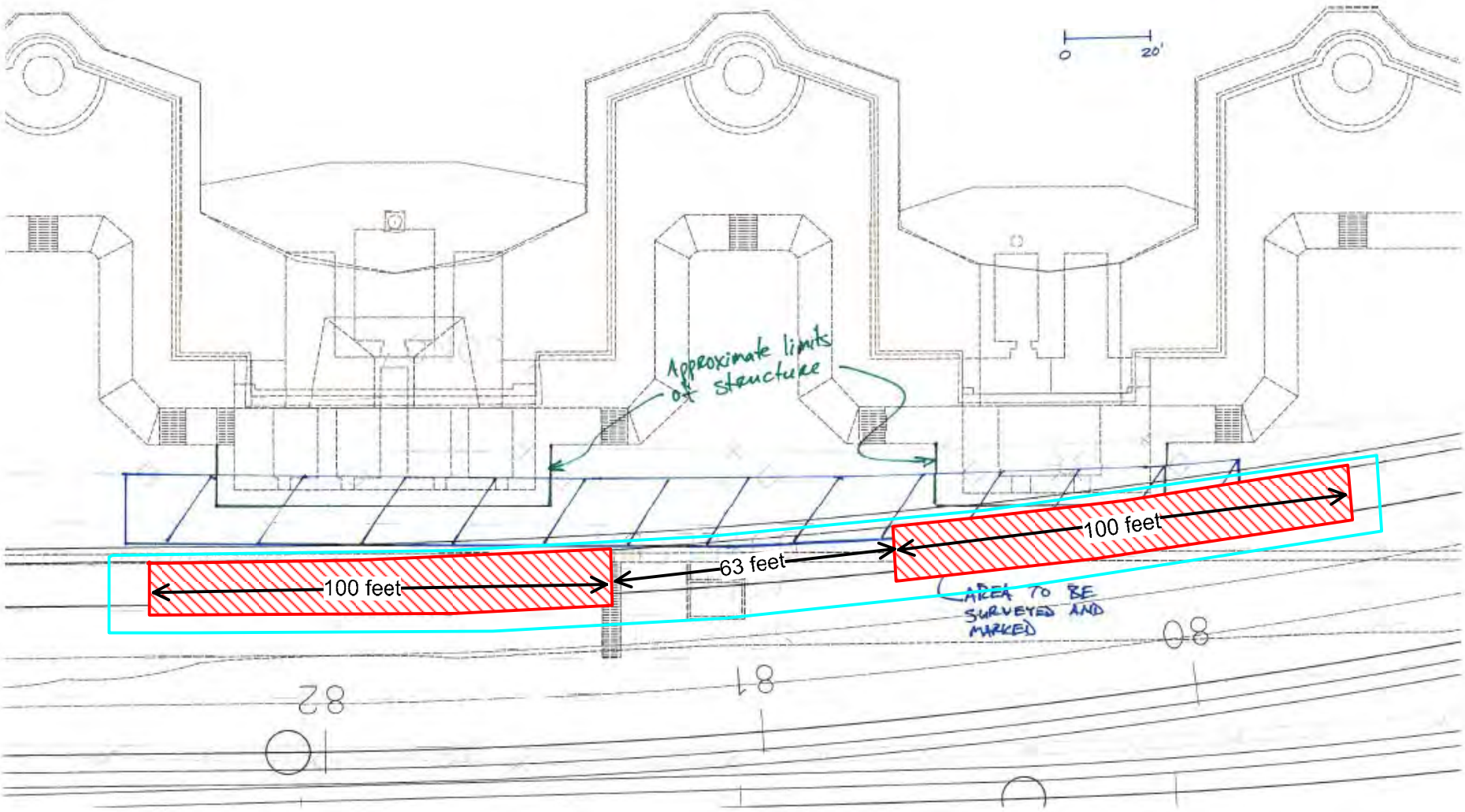
GPR successfully identified two steel reinforced concrete pads beneath the asphalt in Doyle Drive as shown in Figures 1 and 2. Each identified steel reinforced concrete pad is 100-feet in length and extends into the number 2 lane by approximately 1 foot and are separated by a distance of 63-feet as shown in Figure 1.

If you have any questions concerning this investigation, please call Mr. Riches at 818-734-6609.

Sincerely,

Mark Riches, P.GP. 1025
Vice President
GEO*Vision* Geophysical Services

Attachments:
Figure 1: Area of GPR Investigation with Geophysical Interpretation
Figure 2: Sample GPR Traverse Showing Buried Reinforced Concrete
Technical Note – Ground Penetrating Radar Methods



LEGEND

AREA OF GPR INVESTIGATION

EXTENT OF BURIED REINFORCED CONCRETE

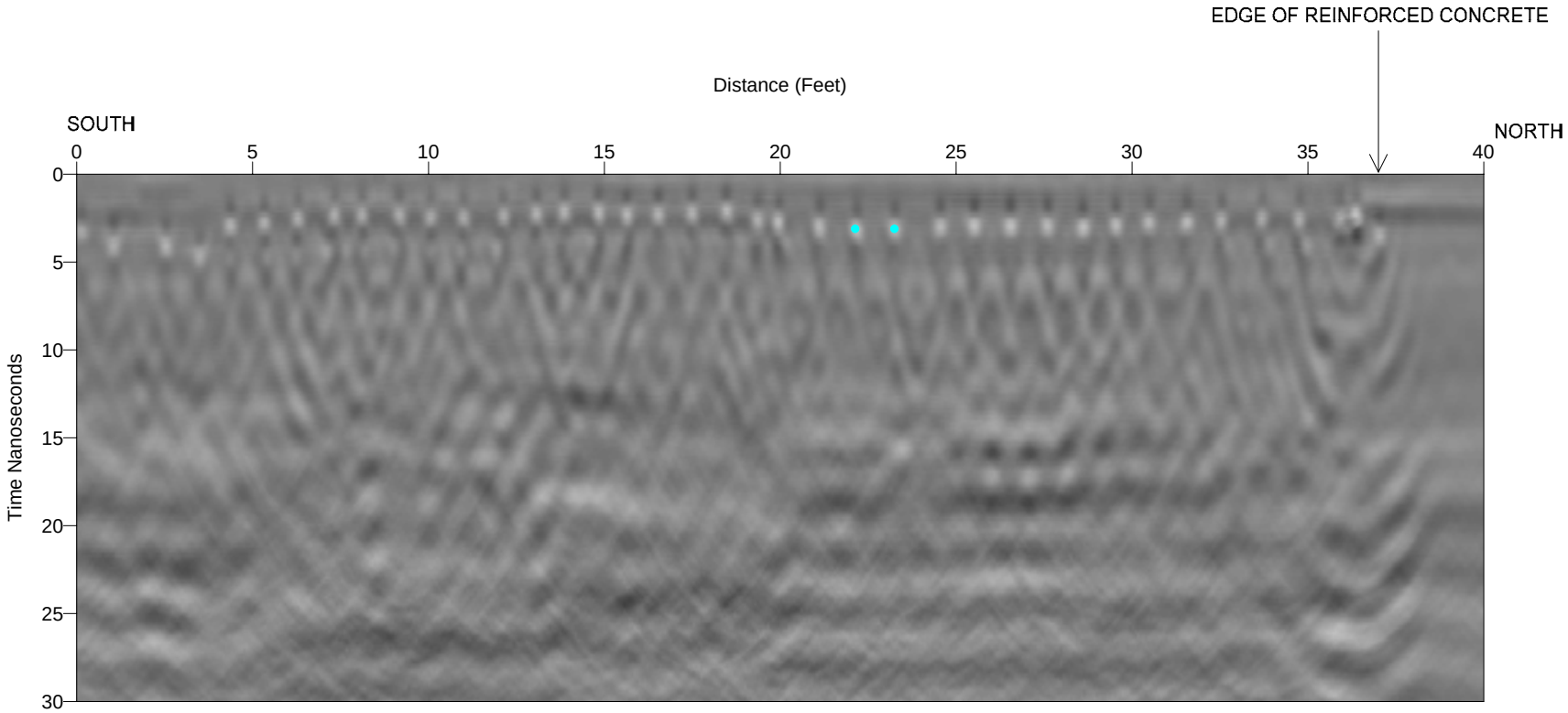
GEOVision geophysical services

Project No. 9101	Date 05-14-09
Developed by: M. Riches	

FIGURE 1 - AREA OF GPR INVESTIGATION WITH GEOPHYSICAL INTERPRETATION

BATTERY STRUCTURE
DOYLE DRIVE
PRESIDIO, CALIFORNIA

ARUP



LEGEND

- REBAR

GEOVision geophysical services

Project No. 9101	Date 05-14-09
Developed by: M. Riches	

FIGURE 2 - SAMPLE GPR TRAVERSE SHOWING BURIED REINFORCED CONCRETE

BATTERY STRUCTURE
DOYLE DRIVE
PRESIDIO, CALIFORNIA

ARUP

GROUND PENETRATING RADAR METHOD IN CONCRETE STRUCTURES

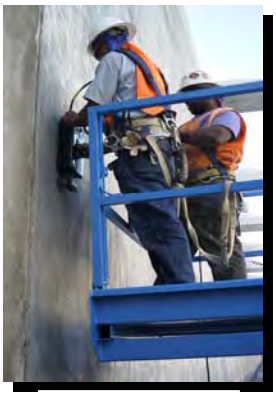
Ground-penetrating radar (GPR) is a high-frequency electromagnetic method that **GEO***Vision* commonly applies to a number of engineering problems associated with both new and aging concrete structures.

A GPR system radiates short pulses of high-frequency EM energy into the ground from a transmitting antenna. This EM wave propagates in the ground at a velocity that is primarily a function of the relative dielectric permittivity of subsurface materials. When this wave encounters the interface of two materials having different dielectric properties, a portion of the energy is reflected back to the surface, where it is detected by a receiver antenna and transmitted to a control unit for processing and display.

GEO*Vision* geophysicists use GPR in concrete to:

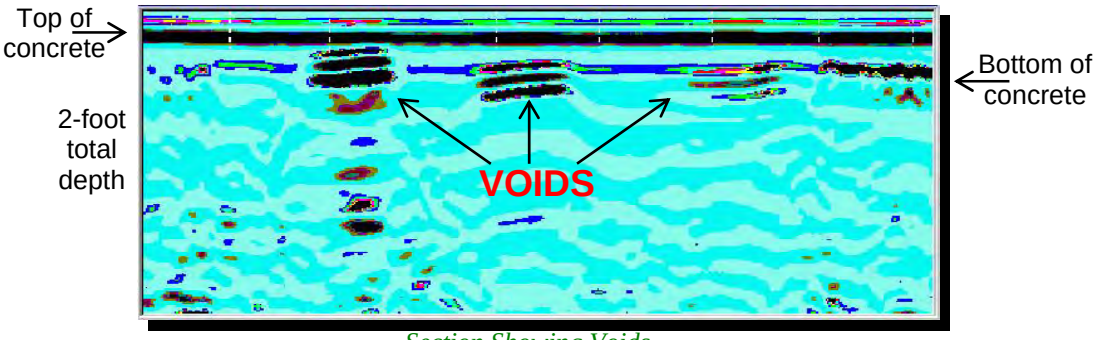
- Map rebar position
- Determine depth of concrete over rebar
- Identify air/water filled voids in or behind concrete
- Determine concrete thickness
- Identify rock pockets within concrete
- Identify leak grouted voids
- Determine asphalt thickness
- Determine rebar corrosion/concrete condition
- Map and define conduits and utility cables within concrete structures

GSSl SIR10B GPR Unit

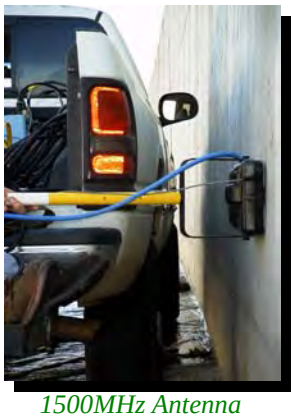


Search For Voids

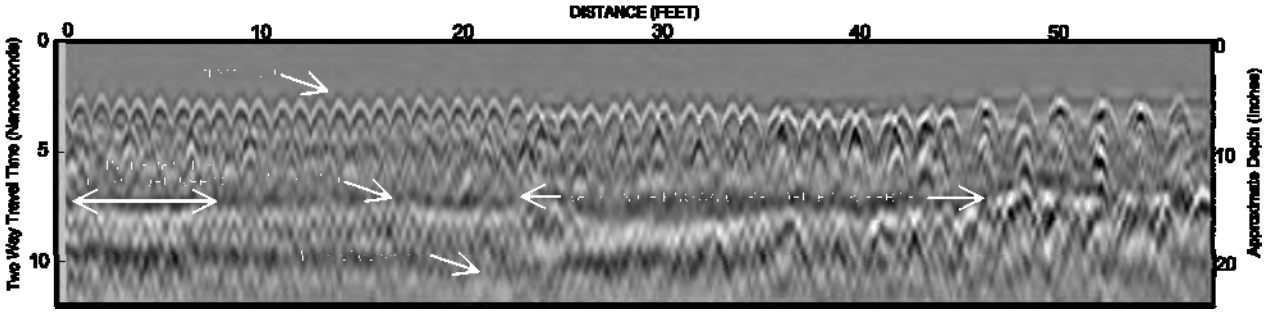
GEO*Vision* has the most advanced GPR unit and processing software on the West Coast. Currently we operate GSSI's SIR10B with 900 and 1500MHz antennas coupled to survey wheels and process using GSSI's Structscan, and G. Olhoeft's GRORADAR, a full waveform-processing package.



Section Showing Voids



1500MHz Antenna



Section Showing Corroded Back Rebar

1124 Olympic Dr., Corona, California 92881, ph. 951-549-1234, fx. 951-549-1236, www.geovision.com