Monte Carlo[3] simulation to develop forecast curves that represent a cost estimate range for the project.

The Project team met with the FHWA in April 2008 and May 2008 to determine the confidence level of the cost estimate range based on the project's current stage of development. Based on those discussions, the FHWA performed a Monte Carlo simulation which resulted in total project cost estimate range of $1.02 to $ 1.14 billion. This validated the Project team's total project cost of $1.045 billion.

Exhibit 2-38
Estimated Construction Cost of Project Alternatives
(in year of expenditure dollars)

Alternative		Option		Roadway	Structures	Construction Total
1	No-Build	—		$0	$0	$0
2	Replace and Widen	No-Detour		$130,300,000	$657,800,000	$788,100,000
		With Detour		$140,00,000	$702,100,000	$842,100,000
5	Presidio Parkway	Diamond	Loop Ramp	$298,800,000	$805,500,000	$1,104,300,000
			Hook Ramp	$297,300,000	$782,000,000	$1,079,300,000
		Circle	Loop Ramp	$299,100,000	$805,500,000	$1,104,600,000
			Hook Ramp	$297,500,000	$782,000,000	$1,079,500,000
		Merchant Ramp		$16,100,000	$1,300,000	$17,400,000
	Preferred			$281,100,000	$571,500,000	$852,600,000

Source: Parsons Brinckerhoff, 2008

2.8 Construction Activities (Alternatives 2 and 5)

As part of this environmental analysis, a preliminary construction plan was developed. The following discussion provides an overview of the possible construction scenarios for Alternatives 2 and 5.

2.8.1 Construction Staging for Alternatives 2 and 5

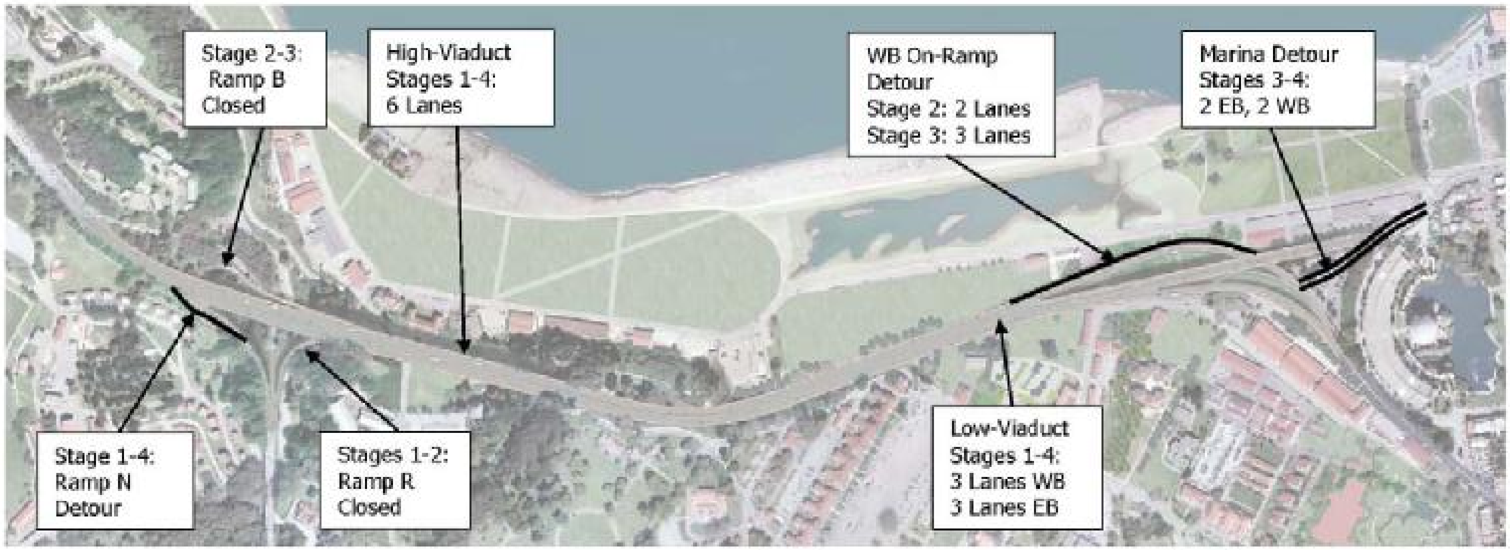
Staging areas vary by alternative. The Replace and Widen Alternative – No-Detour Option would only use the parking lot of the Post Exchange and Commissary as the primary staging area. For the Replace and Widen Alternative - Detour Option, the primary staging would occur on the parking lot and the site of both the Post Exchange (Buildings 605 and 606) and Commissary (Buildings 610 and 653). The primary staging area for the Presidio Parkway Alternative

[3] *A Monte Carlo simulation calculates multiple scenarios of the outcome by continually sampling random values from the expected variance. The simulations ran by FHWA consisted of 10,000 iterations.*

would be the Post Exchange building site and parking lot. Each alternative would use a secondary staging area on the parking lot between Buildings 230 (Presidio Archeology Lab) and 1063 (Medical Supply Warehouse). Access to the buildings adjacent to the staging areas and throughout the Presidio would be maintained during the construction period, which is estimated to last three years and four months for Alternative 2, No-Detour Option, four-years and three months for Alternative 2, With-Detour Option, and four years and seven months for Alternative 5.

Storage of equipment and materials on-site would be limited to the staging and construction areas to minimize ground disturbance. The majority of equipment and materials would be transported to the site using designated haul roads during daytime hours to minimize disturbance to the surrounding residential neighborhoods and to conform with the city of San Francisco construction noise ordinance. Access for construction vehicles and equipment would be via Lombard Street, Richardson Avenue, Doyle Drive from the west, and Veterans Boulevard. Mason Street and Lincoln Boulevard have been identified as haul roads within the Presidio. Additional haul roads, including completed detour roads, would be identified prior to the start of construction. Following construction, all haul roads would be restored to existing conditions, or as defined by the land managing agency. **Exhibits 2-39** through **2-41** on the following pages present preliminary staging plans for Alternatives 2 and 5.

Exhibit 2-39
Alternative 2, Replace and Widen – No-Detour Option
Construction Staging Plan



Stage 1

Construction: Construct southern portion of high-viaduct and outside widening portion of low Viaduct. Demolish Ramp R. Construct portion of temporary widening of WB on-ramp from Richardson Blvd. and temporary Ramp N.

Detours: WB and EB Doyle Drive traffic on existing alignment. Ramp R is closed.

Stage 2

Construction: Demolish Ramps N and B. Complete construction of southern portion of high-viaduct and replacement of Ramp R and Ramp N. Construct portion of inside widening of low-viaduct, temporary detour to Marina Blvd., and remainder of temporary WB on-ramp from Richardson Blvd.

Detours: Divert EB Doyle Drive to SB Park Presidio Blvd. traffic on to temporary Ramp N. Ramp B is closed.

Stage 3

Construction: Demolish old high-viaduct and construct north portion of new structure. Replacement of Ramp B. Demolish old low-viaduct and construct remainder of new structure. Demolish old off-ramp to Richardson Blvd.

Detours: Traffic is moved on to the southern portion of the new high-viaduct. New Ramp R is opened to traffic. Traffic is switched to portion of new low-viaduct. Marina traffic is switched to temporary detour.

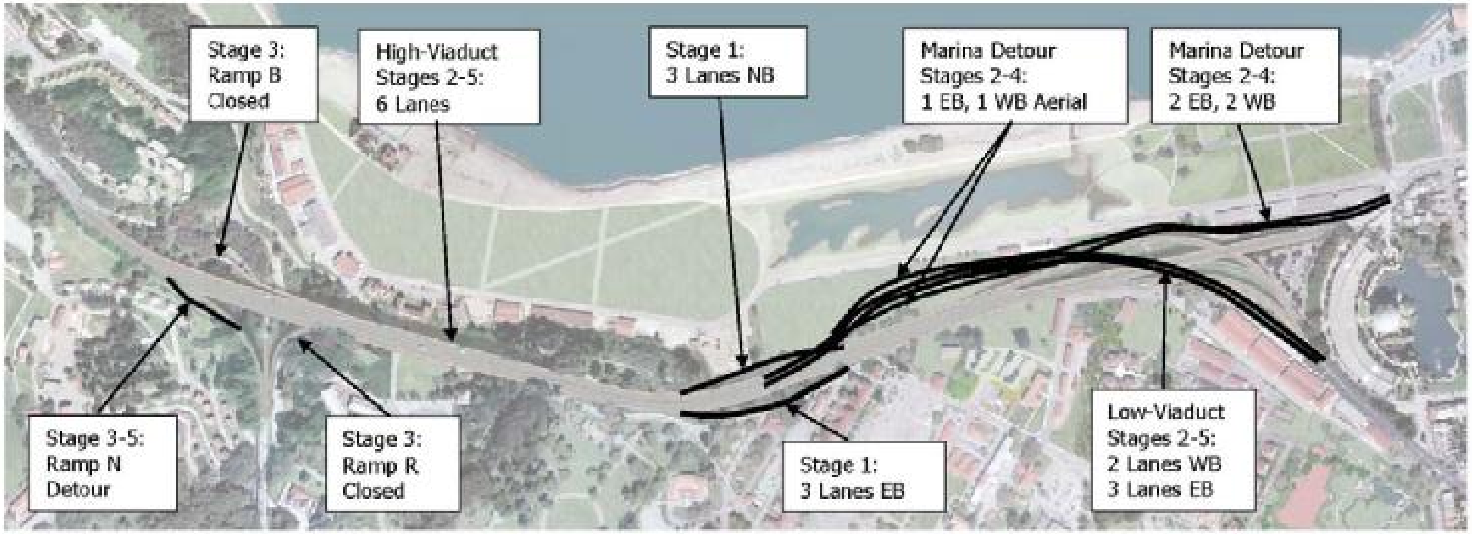
Stage 4

Construction: Complete construction of closure pour and median barrier of high- and low-viaduct. Remove all remaining temporary detours.

Detours: Shift all traffic on to new facility.

Construction Duration: 3 years 4 months

Exhibit 2-40
Alternative 2, Replace and Widen – With Detour Option
Construction Staging Plan



Stage 1
Construction: Replace west portion of low-viaduct between the Cemetery and Main Post.

Detours: WB and EB Doyle Dr. traffic diverted on to temporary detours north and south of construction area.

Stage 2
Construction: Construct southern portion of high-viaduct and temporary Ramp N, demolish Ramp R and remove temporary detours north and south of the west portion of low-viaduct. Construct Marina and low-viaduct detours.

Detours: WB and EB Doyle Drive traffic switched back to existing alignment.

Stage 3
Construction: Demolish Ramps N and B. Complete construction of southern portion of high-viaduct, replacement of Ramp R and Ramp N, and replace low-viaduct.

Detours: East of the Cemetery, WB and EB traffic is diverted on to a temporary structure north of the low-viaduct. The detour goes over Halleck St., the existing structure, and connects to Richardson Ave. near the Palace of Fine Arts. Marina traffic splits off the main detour west of Halleck St. on to a separate temporary structure that goes over Halleck and Marshall streets and connects to Marina Blvd. at Lyon St. Divert EB Doyle Dr. to SB Park Presidio Blvd. traffic on to temporary Ramp N. Ramp B is closed.

Stage 4
Construction: Demolish old high-viaduct and construct north portion of new structure. Replacement of Ramp B. Remove all temporary detour structures.

Detours: Traffic is moved on to the southern portion of the new high-viaduct. New Ramp R is opened to traffic.

Stage 5
Construction: Complete construction of closure pour and median barrier of high-viaduct. Remove temporary Ramp N.

Detours: Shift all traffic on to new facility.

Construction Duration: 4 years 3 months

Exhibit 2-41
Alternative 5, Presidio Parkway
Construction Staging Plan

<u>Stage 1</u>
Construction: Construct portions of EB DD from the Park Presidio Interchange to Richardson Ave. Construct offline portions of WB DD between the Battery and Main Post Tunnels and between the Park Presidio Interchange and the Toll Plaza. Construct portions of the Park Presidio Interchange ramps. Construct portions of the Girard Rd. Interchange. Construct temporary detours for WB and EB low-viaduct at Richardson Ave. Construct temporary detours for Park Presidio Interchange ramps. Construct temporary detour for Richardson Ave. slip ramp.

Detours: Divert EB and WB DD on to detours between low-viaduct and Richardson Ave. Divert EB DD to SB PP and from NB PP to WB DD ramps on to temporary detours. Divert NB PP to EB DD on to a combination of temporary and permanent ramp. Divert WB DD to SB PP on to a combination of temporary and permanent ramp. Divert traffic from Richardson Ave. slip ramp on to temporary detour. Close Halleck St. after reconstruction of Lincoln Blvd.

Construction Duration: 4 years 7 months

<u>Stage 2</u>
Construction: Construct WB high-viaduct between Park Presidio Interchange and the Cemetery. Construct remaining portions of the Battery Tunnel. Construct WB DD causeway at Tennessee Hollow. Remove the Marina Viaduct from Tennessee Hollow to Marina Boulevard. Complete construction of Girard Road Interchange. Remove temporary detour fro EB DD to Richardson Avenue. Remove temporary detour from NB PP to EB DD.

Detours: Divert EB DD on to permanent alignment but with 3 lanes. Open permanent WB DD between the Park Presidio Interchange and the Toll Plaza. Open permanent NB PP to WB DD ramp and permanent NB PP to EB DD ramp.

<u>Stage 3</u>
Construction: Remove portions of the existing high-viaduct and construct the remaining portion of the permanent ramp from WB DD to SB PP. Complete construction of the Battery Tunnels. Remove the low-viaduct between the Cemetery and Halleck Street. Complete construction of EB DD and construct additional portions of WB DD from Cemetery to Halleck Street.

Detours: Divert WB DD on to a combination of temporary and permanent alignment from Richardson Avenue to the Toll Plaza.

<u>Stage 4</u>
Construction: Complete WB DD Main Post Tunnel and construct Halleck Street. Remove remaining portion of existing high-viaduct and residual segments of existing and temporary facilities.

Detours: Open all traffic movements to permanent alignments and open Halleck Street.

Design Options
<u>Merchant Road Option:</u> If selected, this option would be constructed during Stage 1.

<u>Hook Ramp Option:</u> If selected, this option would eliminate the need for the NB PP to SB DD ramp detour during Stages 1-2. Subsequent stages would remain unchanged.

<u>Circle Drive Option:</u> If selected, this option would eliminate the need for the Richardson slip ramp detour. Subsequent stages would remain unchanged.

2.8.2 Construction Methods

Alternatives 2 and 5 would involve standard construction techniques and require large-scale construction equipment and labor-intensive activities. General activities would include:

- mobilization, clearing of vegetation and removal of existing facilities;
- excavation, grading, stockpiling of rock and soil;
- installation of temporary works such as excavation shoring, temporary supports, falsework and formwork; and
- foundation installation, roadway construction, placement of reinforced concrete, erection of structural steel and precast concrete, fill placement and compaction, landscaping, and demobilization.

Equipment would include concrete saws, concrete breakers and impact hammers, pile drilling and driving rigs, pile hammers, vibratory hammers, bentonite mixing and processing equipment, earth moving equipment, cranes, hydraulic jacks, on-site concrete batching plant, concrete trucks, well-point pumps, and material delivery trucks. Driven piles would only be used in locations where there would be no potential damage to historic structures. Quieter operations are achievable by using technologies such as mufflers and other types of noise dampers attached to equipment. Moreover, quiet pile installation technologies were investigated. These included the more common vibratory hammer and also a relatively new technology known as the "Silent-Piler" which uses the "press-in" method. It has proved to be very promising and may also be used.

Methods used to construct foundations, tunnels, depressed sections, and retaining walls would include the use of: sheet-piles, tie-back walls, soldier pile walls, cut-off walls (secant pile and diaphragm walls), cast-in-drilled-hole (CIDH) concrete piles, and the similar cast-in-steel-shell (CISS) concrete piles, which differ in that the steel shell that supports the hole would remain as part of the pile structure. Piling would be installed in rock and soil; some locations would require drilling, driving and a combination of the two.

General methods used to construct aerial structures would include the use of; cast-in-place post-tensioned (CIP/PS) concrete, structural steel erection, and pre-cast pre-stressed concrete (PC/PS) erection. Specialized overhead construction techniques and special falsework were considered to minimize ground disturbance.

CIDH and slurry walls would use bentonite slurry to maintain the shape of excavations. Bentonite processing plants are typically self contained units located at excavation sites which produce low risk clay slurry (bentonite).

Selection of methods would depend on the type of structure selected during final design and would take into account cost, feasibility of construction, the construction marketplace, natural environment, and avoidance of cultural resources.

Aerial Superstructures and Substructures

There were several superstructure types considered for the aerial structures: the CIP/PS box girder, steel tubular deck truss, steel plate girder and CIP/PS composite box-girder with truss laterals.

The CIP/PS conventional box-girder design is standard in California and requires shorter spans and therefore more support columns. The other structure types allow for longer spans of up to 80 meters (262 feet).

The structure types considered at various locations along the facility were:

- *Park Presidio Interchange Area.* The structures in this area included a CIP/PS slab viaduct carrying Route 1 and a CIP concrete "U" section ramp that was a closed box passing under Doyle Drive.
- *High-Viaduct and Access Ramps.* The superstructure types being considered were: the CIP/PS box girder, steel tubular deck truss, steel plate girder and CIP/PS composite box-girder with truss laterals.
- *Eastern Bluff at the Battery.* Retaining wall and cut-and-cover CIP concrete tunnel.
- *Main Post.* Covered CIP concrete tunnel supported on piles.
- *Marina Viaduct.* Two types were considered: the CIP/PS conventional box girder and a modified CIP/PS box girder with overhangs supported on PC/PS brackets.
- *Tennessee Hollow and Girard Road Area.* The structures in this area included a CIP/PS slab "causeway", CIP concrete "U" section supported on piles and installed using cut-off walls, retaining walls and a simple span CIP/PS bridge.

Aerial structure foundations would most likely be CIDH or CISS piles approximately 20 meters (65 feet) long and 0.9 to 1.2 meters (3 to 4 feet) in diameter. The installation of piles would require either drilling a hole to a pre-determined depth or driving a casing and removing the soil. A rebar support cage would then be lowered into the center of the hole or casing and concrete poured in, forming the pile. Depending on groundwater levels, full-length casings could be required but if not, the hole would be filled with bentonite slurry to stabilize the walls. This would require a bentonite processing plant on-site to process displaced bentonite as concrete is poured. The slurry would be displaced from the hole as the concrete is placed from a concrete pump truck using concrete delivered from mix trucks or from an on-site plant.

Tunnels

The tunnels would be constructed using the cut-and-cover method. The typical sequence for construction would include:

- excavation to the necessary length and depth;

- installation of required substructures and ground water conveyance systems, and if necessary, installation of waterproof membrane;
- pouring of concrete for the base slabs, walls, and the roof;
- covering the top and sides of the tunnel with a waterproofing membrane; and
- backfilling over the top of the tunnel to create the approved topography.

Because of potential hydrological and biological sensitivity at the eastern bluffs north of the San Francisco National Cemetery, between McDowell Avenue to the west and the eastern edge of the cemetery to the east, further hydrogeologic investigations would be conducted before final design to determine the hydrogeology and extent of groundwater flow. A water transfer concept has been developed that, if necessary, can transfer groundwater around the tunnel without allowing longitudinal flow along the exterior of the concrete walls to maintain wetland vegetation on the northern bluff face. The concept includes high-permeability strip drains to intercept groundwater on the upstream (south) side of the tunnel and transport it around the outside of the tunnel to locations on the downstream (north) side of the tunnel. As part of final design, careful evaluation of subsurface conditions would be undertaken for design and installation of a hydrologic conveyance system.

At the closest point at the National Cemetery, the limit of the tunnel structure would be one meter (three feet) north of the National Cemetery fence line. No tiebacks would be used in this area. However, if necessary a rigid shoring system would be incorporated into the final tunnel wall and designed to minimize any ground movement and avoid the cemetery.

Earthwork

It is anticipated that material excavated during construction of the tunnels would be suitable for reuse as fill in the project corridor. With Alternative 5, approximately 191,000 cubic meters (250,000 cubic yards) would be excavated and returned as fill. Excess material would require off-site disposal. Alternative 2, No-Detour Option would require 196,000 cubic meters (256,000 cubic yards) of excavation, of which 126,000 cubic meters (165,000 cubic yards) is not reusable. The With-Detour Option would require 156,000 cubic meters (204,000 cubic yards) of excavation, of which 85,000 cubic meters (111,000 cubic yards) is not reusable. Both options would require imported fill (see **Exhibit 2-37** provided earlier in this chapter). For reuse of excavated soils in the project corridor, the Trust's thresholds for soil contaminants would be followed.

Bridge Removal

The steel deck truss at the Presidio (High) Viaduct would be removed from the top down within its footprint. The reinforced concrete and steel stringer approaches would be removed similarly. The deck would be removed first, followed by removal of the steel pieces by flame cutting the steel into manageable pieces. Concrete substructures would be removed using breakers.

The cast-in-place Marina (Low) Viaduct would generally be removed using breakers. In the areas where vibrations must be controlled, sections can be saw-cut into manageable pieces and lifted onto trucks for breakup in another location. Debris would be sorted and piled and then removed. Dust would be controlled through appropriate dust control measures.

Detours

The Alternative 2, With Detour Option would require a 20.4-meter (67-foot) wide temporary elevated detour facility to be constructed to the north of existing Doyle Drive to maintain traffic through the construction period. Access to Marina Boulevard during construction would be maintained on an elevated temporary structure south of Mason Street. On- and off-ramps to the mainline detour facility would connect to the existing Marina Boulevard/Lyon Street intersection. The detour structure would require the temporary removal of four Mason Street warehouses (Buildings 1185, 1184, 1183, and 1182).

The detour structures would be removed following completion of the permanent structures, and the buildings would be returned to their original location.

Demolition of Detours and Existing Structures

Standard demolition equipment would be used to dismantle the existing structures and the temporary detour structures after completion of the replacement structures. Demolition would include cutting and pulverization of concrete into pieces on-site that could be used as back fill in the project corridor. Piles from the existing structure would be cut off to an elevation one meter (3.28 feet) below grade per Caltrans standard specifications. Curtains may be required during demolition of existing structure to contain release of airborne lead.

2.8.3 Construction Timing

The preliminary construction staging assumes that a typical construction schedule would be used for the Doyle Drive Project. This would include the scheduling of some activities during hours of low traffic volumes. Low traffic volumes would occur on Doyle Drive at night and on local roads during the middle of the day as well as at night. The purpose of scheduling activities during these hours is to ensure that roadways (in the construction area) are open during the peak traffic times to minimize traffic disruption. The types of construction activities which may occur in the hours during low traffic volumes are:

- erection/removal of falsework to permit construction overhead;
- erection/removal of temporary shielding to permit demolition overhead;
- demolition of structures over minor roads; and
- construction of the Main Post tunnel roof for Alternative 5.

2.8.4 Temporary Roadway Closures

To accommodate the construction staging for Alternatives 2 and 5 there will need to be planned, short duration closures of the mainline, ramps, and local roads. These closures would occur during low traffic volume hours (short-term closure) to minimize impacts to traffic.

Exhibit 2-42 depicts the anticipated short-term closures and associated construction activities based on the conceptual staging plans developed for the project. In addition, lane closures would be required to erect overhead signs needed for the project. Type and location of signs would be determined during the final design phase.

Exhibit 2-42
Short-Term Roadway Closures During Construction: Low Traffic Volume Hours

Location of Closure	Purpose of Closure	Alternative 2 No-Detour	Alternative 2 With Detour	Alternative 5 Park Presidio
NB Doyle Drive	Main Post Tunnel Roof Construction			X
SB Doyle Drive	Main Post Tunnel Roof Construction			X
NB Doyle Drive to NB Veterans Blvd.	Bridge Removal/Falsework			X
NB Veterans Blvd. to NB Doyle Drive	Temporary Bridge Construction and Removal/Bridge Removal/Falsework	X	X	X
NB Doyle Drive to SB Veterans Blvd.	Bridge Removal/Falsework			X
Lincoln Blvd. at Park Presidio Interchange	Falsework	X	X	X
Crissy Field Avenue	Bridge Removal/Falsework	X	X	X
Mc Dowell Road	Falsework	X	X	X
Halleck Street	Bridge Removal/Falsework	X	X	
Girard Road	Bridge Removal			X
NB Richardson Ave at Doyle Drive	Bridge Removal/Falsework/ Temporary Bridge Support			X
NB Richardson Ave to NB Doyle Drive	Temporary Bridge Support			X
Marshall Street	Bridge Removal/Falsework	X	X	X
Javowitz Street	Bridge Removal/Falsework	X	X	X
Crook Street	Bridge Removal/Falsework	X	X	
Richardson Slip Ramp	Bridge Removal			X

2.8.5 Long-Term Roadway Closures

The conceptual staging plans also identified the need for long-term closure (greater than one month) for ramps and local roads. **Exhibit 2-43** depicts the long-term closures and associated construction activities.

More information regarding anticipated roadway closures is provided in the *Draft Transportation Management Plan,* June 2007 (see **Appendix K**), developed for this project.

Exhibit 2-43
Potential Long-Term Roadway Closures

Location of Closure	Purpose of Closure	Alternative 2 No-Detour	Alternative 2 With Detour	Alternative 5 Park Presidio
NB Doyle Drive to SB Veterans Blvd	Ramp Reconstruction	X	X	
NB Veterans Blvd to SB Doyle Drive	Ramp Reconstruction	X	X	
Lincoln Blvd	Mainline Doyle Drive Construction	X		X
Halleck Street	Mainline Doyle Drive Construction and Road Reconstruction			X

2.9 Construction Activities for the Preferred Alternative

As part of this environmental analysis, a preliminary construction plan was developed for the Preferred Alternative. The following section provides an overview of the possible construction scenario that may be used for the Preferred Alternative.

2.9.1 Construction Staging

The primary staging area for the Preferred Alternative will be the Post Exchange building site and parking lot. The secondary staging area will be located on the parking lot between Buildings 230 (Presidio Archeology Lab) and 1063 (Medical Supply warehouse) (see **Exhibit 2-44**). Access to the buildings adjacent to the staging areas and throughout the Presidio will be maintained throughout the construction period, which is estimated to last four years or less (see **Exhibit 2-45**).