HELIPAD SITE STUDY

INTRODUCTION

San Francisco General Hospital (SFGH) is located in a highly urbanized section of the City situated between the Mission District and Potrero Hill communities. The main campus covers approximately 23 acres west of U.S. Highway 101 and east of Potrero Avenue. This chapter discusses possible locations for the helipad on the San Francisco General Hospital main campus. It describes the specific objectives for the helipad location, helipad design criteria, and evaluates selected sites.

It does not consider a possible off-site location for the helipad for three principal reasons: (1) an offsite location is not appropriate to the direct emergency room access required for trauma patients; (2) an offsite location will not contribute to the high standards of care required for the inter-facility transfer of critically ill or pediatric patients; and (3) the helicopter to ambulance to hospital transfer required from a remote site increases the potential for mishaps to occur as a result of additional patient handling.

Four locations on the campus were identified as possible helicopter landing sites. A fifth location was identified on the hospital parking structure south of 23rd Street. Four of the sites were on rooftops and one was on the ground in the street-level parking lot near the hospital emergency room entrance.

HELIPAD DESIGN CRITERIA

The state permitting agency for a helipad is Caltrans Aeronautics, a division of the State Department of Transportation. This agency makes the final determination as to the safety and appropriateness of the location for a helipad and the adequacy of the helipad design. Caltrans has adopted many of the design stan-

dards set forth in the Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5390-2A, and has developed some additional criteria of its own (Title 21, Sec. 3525 through 3560, California Code of Regulations). In order to obtain a permit to operate a heliport, it is necessary to meet these standards.

OBJECTIVES

A Modern Rooftop Hospital Helipad

In addition to meeting the state's safety criteria and design standards, the objectives for locating the helipad on the SFGH campus are as follows:

- Be located as close as possible to the emergency department to minimize travel distance, and patient transfers and handling; and
- Be located on a site where the helipad can be secured and the arrival and departure (flight) paths not compromised in the future by maturing trees, new development, or vehicle traffic.
- Be located on a site that would have as little noise impact on the surrounding community as possible.

DESIGN CRITERIA

A helicopter landing site must meet FAA and Caltrans Aeronautics design criteria. The location of the helipad must also satisfy the standards and the needs of the hospital. An overriding consideration is that the establishment of the helipad should benefit the community through improving patient transport and saving lives.

Heliport, Helistop or Helipad?

There are minor distinctions between the words *heliport, helistop, and helipad.* The same design standards apply to all. A heliport, helistop and a helipad are areas of land, water or structure used or intended to be used for the landing and takeoff of helicopters. A *heliport* is a more elaborate facility usually associated with helicopter fueling, maintenance hangars or passenger waiting areas. The word *helipad* as used in this report can be inter-

changed with *helistop.* It is a minimally designed heliport used for the transportation of patients.

Helipad. A helipad is not just a circle painted on the ground or a raised rooftop structure. The size of the helipad depends upon the size of the largest helicopter or the size parameters (length, width and weight) of a combination of helicopters that may utilize the hospital helipad.

Hospital helipads are generally constructed of concrete and steel. A ground level helipad may be designed with asphalt but it is not recommended. Asphalt has a tendency to soften during hot summer months with repeated usage. The helipad design includes dimensional, obstruction clearances and load bearing criteria.

The typical medical mission flights would be made with medium sized helicopters utilized by the three main helicopter emergency medical services, REACH, CALSTAR, and Stanford LIFE FLIGHT. The design dimensions of their helicopters would be taken into consideration (see Table 1) in determining the appropriate helipad configuration. For example, CALSTAR employs a Bell 222 helicopter with an overall length of 51 ft. While, the Coast Guard helicopter, a Eurocopter AS-365, is shorter but weighs more.

In a major disaster situation with mass casualties, the National Guard may find it necessary to land a UH-60 (Blackhawk) medevac helicopter at SFGH. Hence, the helipad design should consider this potentiality. The UH-60 has an overall length of 65 ft and weighs approximately 22,000 lbs. In order to be prepared for all anticipated contingencies, the helipad should be designed to accommodate the National Guard helicopter.

Table 4-1 shows the requirements for the final approach and takeoff area (FATO), touch down or helipad size (TLOF), and safety areas for various sizes of helicopters.

Table 4-1
HOSPITAL HELIPAD FINAL APPROACH AND TAKEOFF AREA (FATO) AND SAFETY AREA SIZE REQUIREMENTS

	HELICOPTER			HELIPAD		
HEMS	Helicopter Model	Rotor Diameter (Feet)	Length (Feet)	Helipad (TLOF-Min. 40' or Greater)	Approach/Departure (FATO-1.5 X Length)	Safety Diameter (FATO +2/3 Rotor Diameter)
CALSTAR	Bell 222	42	51	42	77	105
"	BO105 CBS	33	39	40	59	81
REACH	Agusta 109A	37	43	40	65	91
Stanford Life Flight	BK117C	37	43	40	65	91
East Bay Reg. Parks	EC-AS350B	36	43	40	65	89
U.S. Coast Guard	EC-AS365	40	45	40	68	96
National Guard	UH-60A	54	65	54	98	134

Potential Flight Paths

According to the FAA and Caltrans, the hospital heliport must have at least one approach/departure flight path. The path should be aligned as much as possible with the prevailing wind, which in the San Francisco Bay area is predominantly from the northwest. Optimum performance for a helicopter as with all aircraft, is to be able to take-off and land into the wind, but it is not an absolute necessity.

Two approach/departure paths oriented to be a minimum of 90 degrees apart are recommended to avoid the helicopter taking off or landing, with a crosswind or tailwind. Thus, should the wind direction change, the pilot could choose to depart on the alternate direction flight path.

The approach/departure corridor extends out from the edge of the approach/departure surface for a distance of 4,000 feet. It rises at a ratio of 1 ft. vertical for every 8 feet horizontal distance traveled. The approval of the flight path by Caltrans Aeronautics requires that this approach surface with the accompanying transitional slopes (which rise at ratios of 1 ft for every 2 feet traveled) should be free of any object penetrations such as trees, parking lot lamp poles or corners of buildings. The flight path at the helipad location does not have to be a narrow path but can be a larger pie-shaped sector provided it meets all of the airspace no-obstruction criteria. This type of approach surface gives the pilot the option to choose the best flight path within that sector given the direction of approach, and the wind and weather conditions at the time of the flight operation.

A macro view of possible approach and departure flight paths is shown in Figures 4-1 and 4-2. HEMS flights can come from many different directions in the greater Bay Area wherever there is an accident or a hospital that needs to transfer a patient to or from SFGH. For noise abatement purposes, the helicopters would follow the major surface arterials and freeways. When the primary flight path is used, the helicopters would approach the landing site from the south, and head the aircraft in a northerly direction in order to land. The existence of a secondary flight path would allow the pilot to takeoff in a

San Francisco General Hospital Proposed Helipad

Primary Flight Path: North Departure

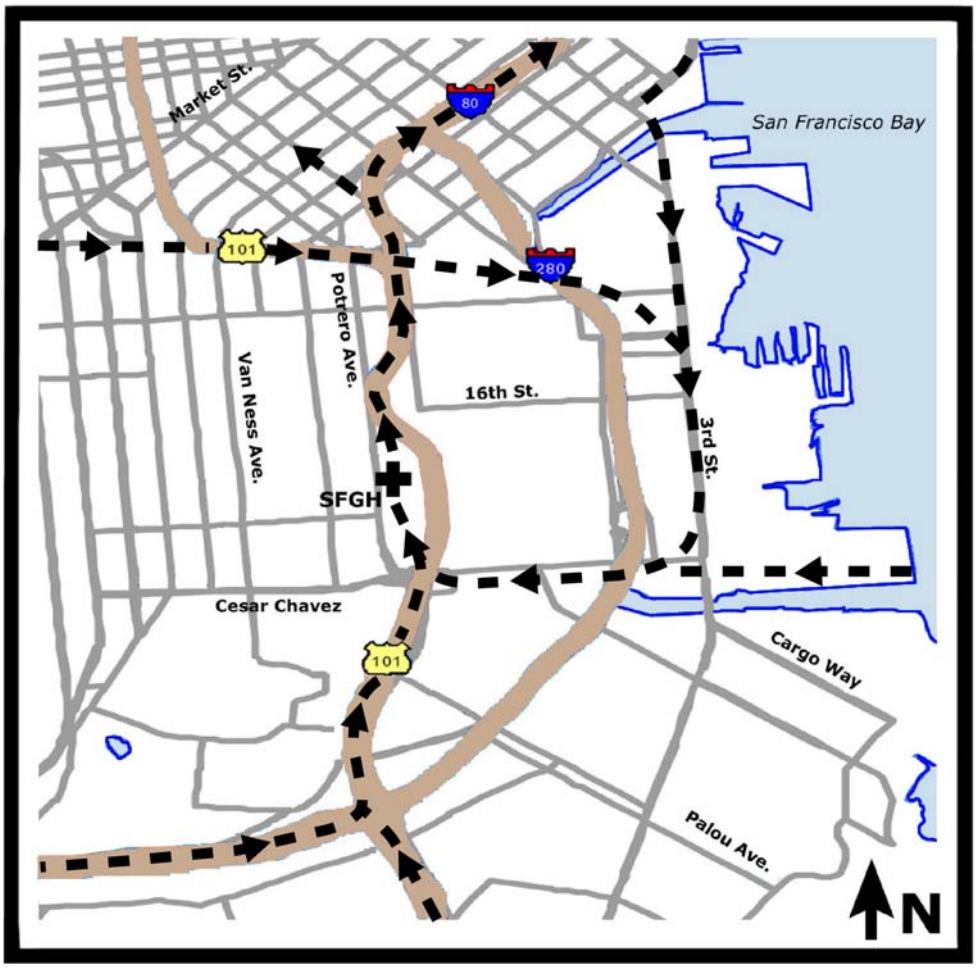


FIGURE 4-1

San Francisco General Hospital Proposed Helipad

Primary Flight Path: South Departure

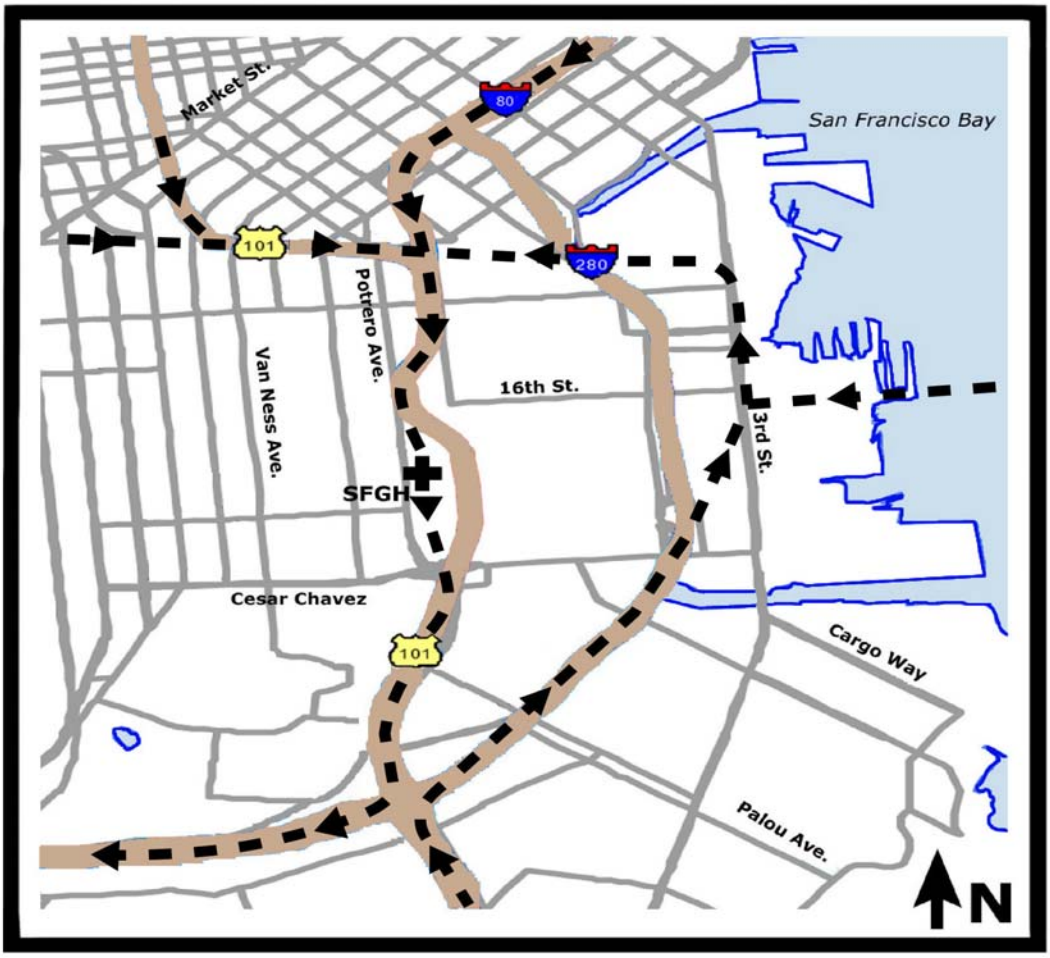


FIGURE 4-2

direction during some periods of the year when the wind comes from the south/southwest (see Fig. 4-2).

Helipad Accessories. There are certain design elements that are common to either a ground level or a rooftop helipad. Helipad lighting is required in order to conduct night landings. All night operating helipads require a lighted wind cone. A rooftop helipad requires additional fire prevention equipment such as one or two wet standpipes and a fuel water separator tank to be used in the event of a fuel spill to prevent the fuel from entering the sewer system. It is recommended that all heliports have fire extinguishers or a rooftop foam system.

If a helipad is higher than 30" above the roof deck, a safety net for fall prevention is required. All of these design and location criteria help in making the helipad more acceptable to the community and a safer place to land.

POTENTIAL HELIPAD SITES

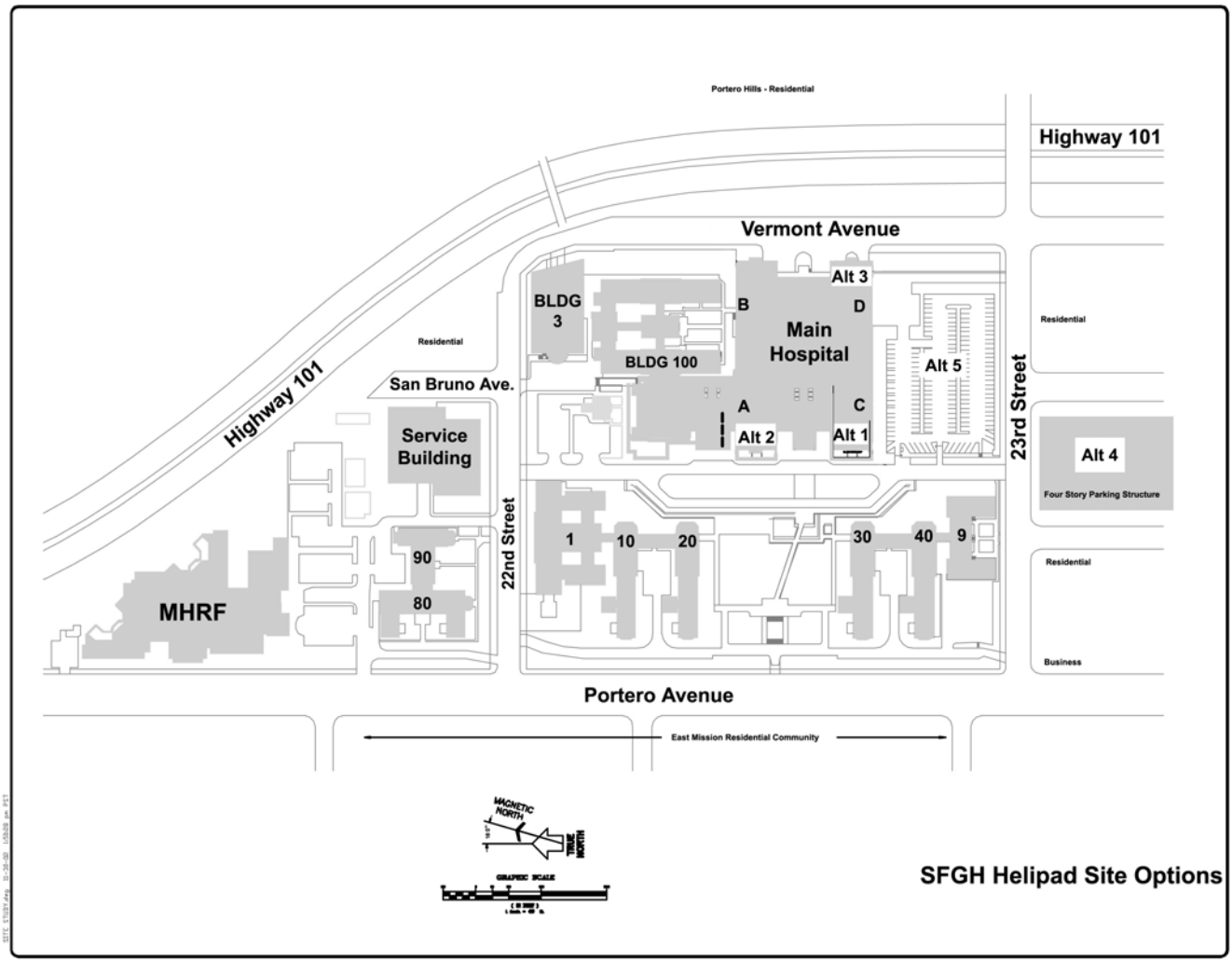
The hospital campus is a reflection of its urban environment and is densely developed. Most of the unbuilt ground level land is dedicated to vehicle parking. There are some grass areas in front of the main entrance. Consequently, the more viable options for helipad locations were above ground level – on the rooftops of hospital related buildings.

The optional sites that were evaluated are shown on Figure 4-3. One of the sites was a proposed ground level location on the Emergency/Visitors Parking Lot immediately adjacent to the Emergency Department entrance. The other four sites were on the rooftops of three wings of the Main Hospital Building (Wings A, C, and D) and the roof of the adjacent Parking Garage.

Rooftop Helipad

A few general comments are relevant to all of the rooftop helipad sites on the Main Hospital Building (Fig. 4-3). The rooftop is the preferred location for a helipad because it is easier to protect the access to the helipad. In most cases, it is the safest and most land-use conservative location for a helipad. Additionally, the rooftop loca-

Figure 4-3 SFGH Helipad Site Options



tion would usually be least affected by future buildings or maturing trees on adjacent property that might interfere with the flight paths. The City/County, which owns the property surrounding the Main Hospital Building, can control what is erected adjacent to the hospital.

As is typical of all rooftop helipads from a noise perspective, when the helicopter is landing or taking off from the helipad there is a decrease in noise exposure to people on the ground in the immediate vicinity of the site due to the elevation of the helipad. There may also be some noise shielding for the community to the east of the Main Hospital Building provided by the mechanical penthouses for Wings A and C, respectively. There would be some noise exposure associated with the helicopter as it flies over the south Parking Garage, the Emergency/Visitor Parking Lot and the buildings on the hospital property to the north/northwest. The mitigating factor would be that the higher noise levels would be within the campus property boundaries (see Chapter 6).

All three hospital wings (A, C, D) are relatively free of obstructions that could interfere with the helipad construction at the site. There are, however, ventilation ducts and wet stand pipes that may need to be relocated. Modifications would need to be made to prevent helicopter exhaust fumes from entering the building. A detailed structural evaluation of the roofs would be conducted by a qualified structural engineer to evaluate the structural integrity of the building should the helipad be located on one of the wings.

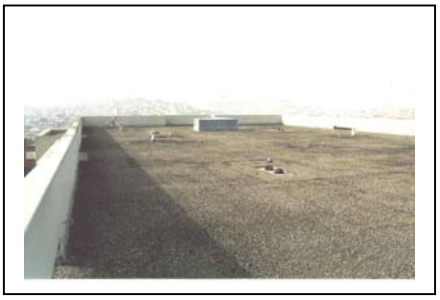
The helipad, where the helicopter eventually touches down on the roof, would need to be raised high enough to clear the surrounding roof parapet walls and the air ventilation shafts. This should be approximately 5 feet above the roof deck. A ramp exit for the gurney and medical staff would go from the helipad to the roof deck level below in the direction of the elevators.

Preliminary studies indicate that elevator access can be accomplished to the roof (see discussion below). The Emergency Department (ED) is located on the first floor in the D Wing of the hospital. A couple of alternatives have been explored. The first was to extend the existing elevator bank in Wing D to the roof level. This elevator

bank on the southeast side of the hospital in Wing D would open directly into the ED. The location of the elevator bank is such that the distance from the alternative sites on the roof would not be significant.

A second alternative is to install a special, enclosed elevator lift in the courtyard between the west and east wings of the Main Hospital Building. This is on the floor immediately below the roof deck. The elevator-lift would come up to the roof deck for easy access with a gurney.

Of the alternative sites evaluated for a helipad, two sites stood out as having the best potential (Sites 1 and 2). Site plan drawings have been prepared for these two sites.



Site 1 (Wing C Rooftop)
Looking West

Site Alternative 1: SFGH Wing C. Site 1 is a helipad location proposed for the rooftop of Wing C of the Main Hospital (see Fig. 4-4). It is to the south of the Main Hospital entrance that faces Potrero Ave. on the southwest wing of the Main Hospital rooftop. This site lends itself to a westerly sectored flight path area of approximately 200-degrees counter-clockwise from San Bruno Ave. to the north, to Highway 101.

The primary flight path will be to the north/northwest since the wind typically comes from this direction. The helicopter would approach from the south along Highway 101. The advantage of this location is its clear approach path from the south. It typically would be over the south Parking Garage and the Emergency/Visitor Parking Lot.

The departure would be to the north/ northwest, avoiding over flying the hospital entrance, and Wing A; then down the medical campus interior parkway and over 22nd Street.

The higher noise levels associated with the landing and takeoff off operations would remain within the hospital boundaries for the most part (see Chapter 6). There would be potential for noise exposure to the medical buildings to the north of the site when the helicopter departs to the north/ northwest.

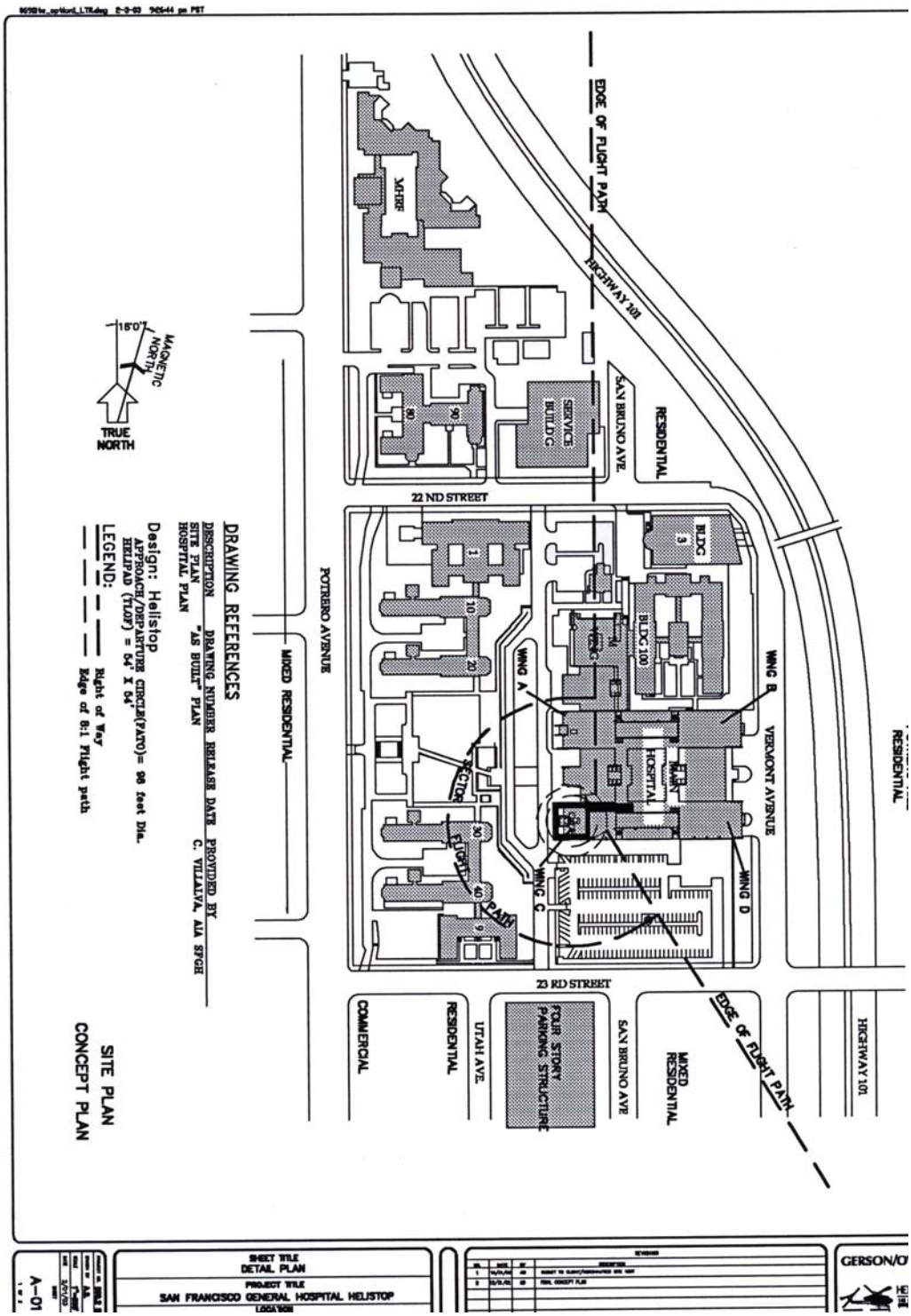


Figure 4-4 Alternative 1 (Wing C) Site Location

There are several antennae and satellite dishes located on the rooftop of the stairway penthouse to the east of the possible helipad that would need to be relocated. There is also an air-conditioning or ventilation duct that would need to be modified.

Site 2 (Wing A Rooftop)
Looking West

Site Alternative 2: SFGH Wing A. Site 2 was identified as the rooftop of the A wing of the Main Hospital Building (see Fig. 4-5). The two north wings are referred to as the A and B wings.

Site 2 (Wing A), is almost in the middle of the medical campus. It is located to the north of the main entrance to the hospital and on the northwest portion of the roof. The sector flight area is very much the same as Site 1. The primary departure flight path from Site 2 would be to the northwest over the campus parkway, and the hospital Service Building to Highway101.

The slight disadvantage of this site over Site 1 is that the approach would be from the south/southwest over the Parking Garage, Emergency/ Visitor Parking Lot, and partially the Main Entrance to the hospital. This may cause some additional helicopter noise and vibration in that area.

The advantage of this location, like Site 1, is that it is on the roof and the departure would be into the predominant wind to the north/ northwest. Assuming that the same modifications can be made to the elevator shaft, then there is good access to the helipad area for the staff and a patient gurney.

There is a large wet standpipe and various ventilation ducts on the roof as in Wing C that would need to be moved or retrofitted to accommodate the helipad.

Site Alternative 3: SFGH - Wing D. Site 3 would be another optional helipad site on the southeastern rooftop portion of the Main Hospital Building in a section identified as Wing D. It is to the southeast of the Main Hospital Entrance.

A possible southern approach path for the helicopter (see Fig. 4-2 which shows the macro view of the Primary

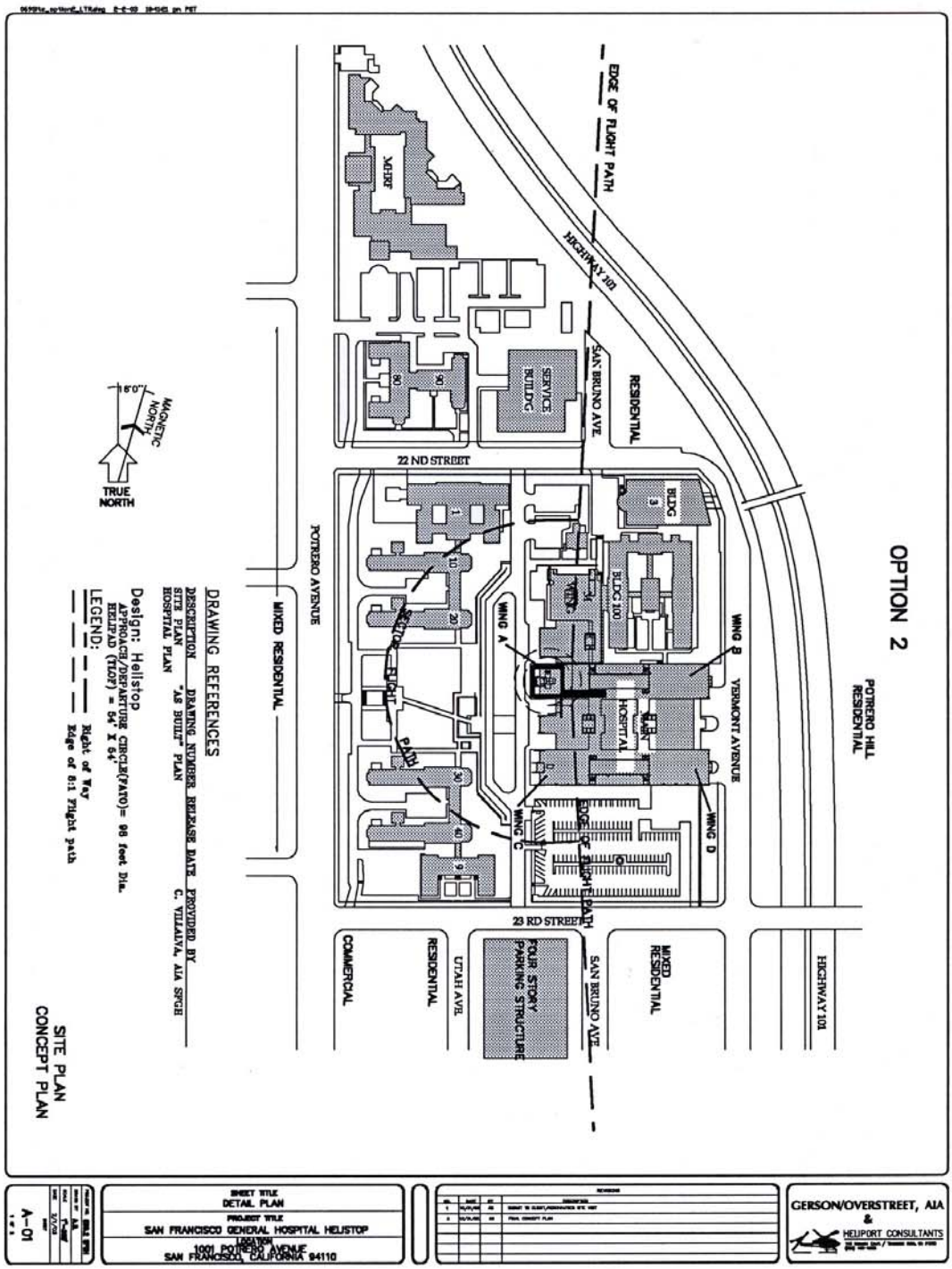


Figure 4-5 Alternative 2 (Wing A) Site Location

Site 3 (Wing D Rooftop)
Looking East

Flight Path) is north on Interstate 101 with a northwesterly wide turn before 23rd Street to the rooftop helipad.

The primary departing flight path from the helipad would be to the north following the curve of Interstate 101 and Potrero Hill. Portions of the hospital building to the north are higher than the flight path and would need to be lighted with red obstruction lights. The geographical components of this flight plan put a limitation on the direction that the helicopter can fly.

The helicopter flight path would be directly over Wing B of the hospital and the medical buildings to the north. There would be no way to avoid them.

The advantage of this location is the close proximity to Interstate 101 and Vermont Ave., which is already a corridor where transportation noise exists. The helicopter could fly down these roadways on approach and departure. The elevator access and assumptions are the same as for Sites 1 and 2.

The significant disadvantage to this site would be the departure and approach over the wing of the hospital and the curved flight track limitation.

Site 4 (Parking Structure)
Looking South

Site Alternative 4: SFGH- Parking Garage. Site 4 was proposed as a helipad on the rooftop of the hospital's Parking Garage located between San Bruno Ave and Utah Street and south of 23rd Street. The primary approach path for the helicopter would be north on Interstate 101 to the intersection with Potrero Ave. then north along Potrero Ave. to just before 24th Street where the helicopter would fly over some residential and commercial buildings to the Parking Garage.

There are more disadvantages than advantages to this location. The main advantage is the access to this pad is somewhat protected. However, unlike the proposed main hospital rooftop locations, the entire Parking Garage rooftop cannot be dedicated to the helipad operations. Consequently, people not associated with the helicopter operations would still have access to this roof in order to park their cars.

This site would require that the patient to be transferred from the helicopter to an ambulance and driven across the street to the hospital emergency room. This would increase the travel time and the "exposure time" for the patient outside of the hospital environment.

While the helicopter may be able to land on the roof, after helipad modifications are made, it is impossible to drive a standard ambulance through the parking structure to the roof because of inadequate clearance for such a tall vehicle between floors. A detailed analysis of elevator access would also need to be performed.

This site would only have a single approach/departure path from the south because the power lines along 23rd Street are an obstruction and block any flight path to the north. Even if they were placed underground at great expense, the elevation of the Main Medical Building would also be considered an obstruction to any proposed flight path.

The structural integrity of the building would need to be evaluated since a separate structure would be erected to raise the helipad above the roof parapets. The location of the helipad on the rooftop would also negatively impact the available vehicle parking. The above disadvantages coupled with an increase in neighborhood residential noise level south of 23rd Street makes this an undesirable site for a helipad.

Site 5 (ED Parking Lot)
Looking South

Site Alternative 5: SFGH - Emergency/ Visitor Parking Lot. Site 5 is proposed as an option for a ground level helipad in the Emergency/Visitor Parking Lot south of the Main Hospital Building. The initial approach path for the helicopter would be north on Interstate 101 with a northwesterly wide turn over the residential area on the south side of 23rd Street to the ground level helipad (see Fig. 4-2).

There are numerous power lines that run along Vermont Avenue and 23rd Street. Additionally, there are tall trees that grow along the western border of Interstate 101 (east of the parking lot) and create a foliage barrier for the residential area to the east. These are all existing obstructions in the imaginary airspace dimension helipad requirements. This site has numerous existing and po-

tential obstructions for the helipad and the flight paths. Closer to the helipad, there is not a clear flight path for the approach from the south and there is no departure path into the prevailing wind to the north or northwest because of the hospital buildings. The heights of the Main Hospital Building to the north and the hospital buildings to the west may prevent the location of a helipad on this site altogether because they would be judged obstructions in the transitional slopes of the helipad approach surfaces.

Raising the pad on an earthen berm would, because of slope construction limitations, probably not increase this site's acceptability. The helipad would have to be raised on a much taller, independently built steel and concrete structure in order to achieve enough clearance over the trees and power lines. Even if the trees and power lines could be lowered to ground level, the helipad would still need to be raised in order for the flight path to clear the motor vehicles and other street related obstructions.

Additionally, the helipad would essentially eliminate most, if not all, of the vehicle parking in this lot. There are too many costly challenges associated with this site to make it a viable option.

CONCLUSIONS

Five possible helicopter landings sites were evaluated in an effort to determine a feasible location that would meet the FAA and Caltrans design requirements, and the hospital's objectives. Table 4.2 shows the list of the potential sites and their recommended rank order of preference from 1 to 5.

The option on Wing D of the Main Hospital Building was not a recommended site because of the limitations on the flight path. The ground level landing site in the Emergency/Visitor Parking lot does not meet the FAA or Caltrans design criteria and the Parking Garage site would not meet the hospital objectives.

Of the four rooftop sites that were evaluated, only two on the Main Hospital Building (Wings A and C) were deemed appropriate locations for a hospital helipad that would provide the best location for patient transfer to the ED.

TABLE 4.2
SAN FRANCISCO GENERAL HOSPITAL
HELIPAD SITE STUDY
SUMMARY

Site Number	Option Site Name	Ranking for Possible Helipad
1	**SFGH Rooftop - Wing C**	**1**
2	**SFGH Rooftop - Wing A**	**2**
3	SFGH Rooftop - Wing D	3
4	SFGH Parking Garage Rooftop - 23rd St.	4
5	Emergency/Visitor Parking Lot (Ground Level)	5

Figures 4-6 and 4-7 contain preliminary site plan drawings for Sites 1 and 2, respectively.

STRUCTURAL CAPABILITIES

The structural Engineering firm of Degenkolb Engineers was tasked with determining if there were any significant structural requirements that would substantially affect the cost of design and construction of a new helipad on the roof of the existing main hospital building at San Francisco General Hospital.[1] The proposed project would consist of the construction of a 3,000 square foot helipad on either the northwest or southwest wings of the main hospital. Other factors of consideration included that the helipad must be mounted on the roof such that the landing surface is above any vertical obstructions on the possible flight paths. Therefore, the landing surface must be higher than the existing 3'-6" high concrete parapet walls and ventilation penthouses. In order to transport patients on gurneys, a ramp from the landing surface to the existing roof will be required as part of this project. Additionally, an elevator or lift would be required to transport patients on gurneys from the roof to the floors below.

[1] Degenkolb Engineers, Memorandum:Helipad. January 23, 2003.

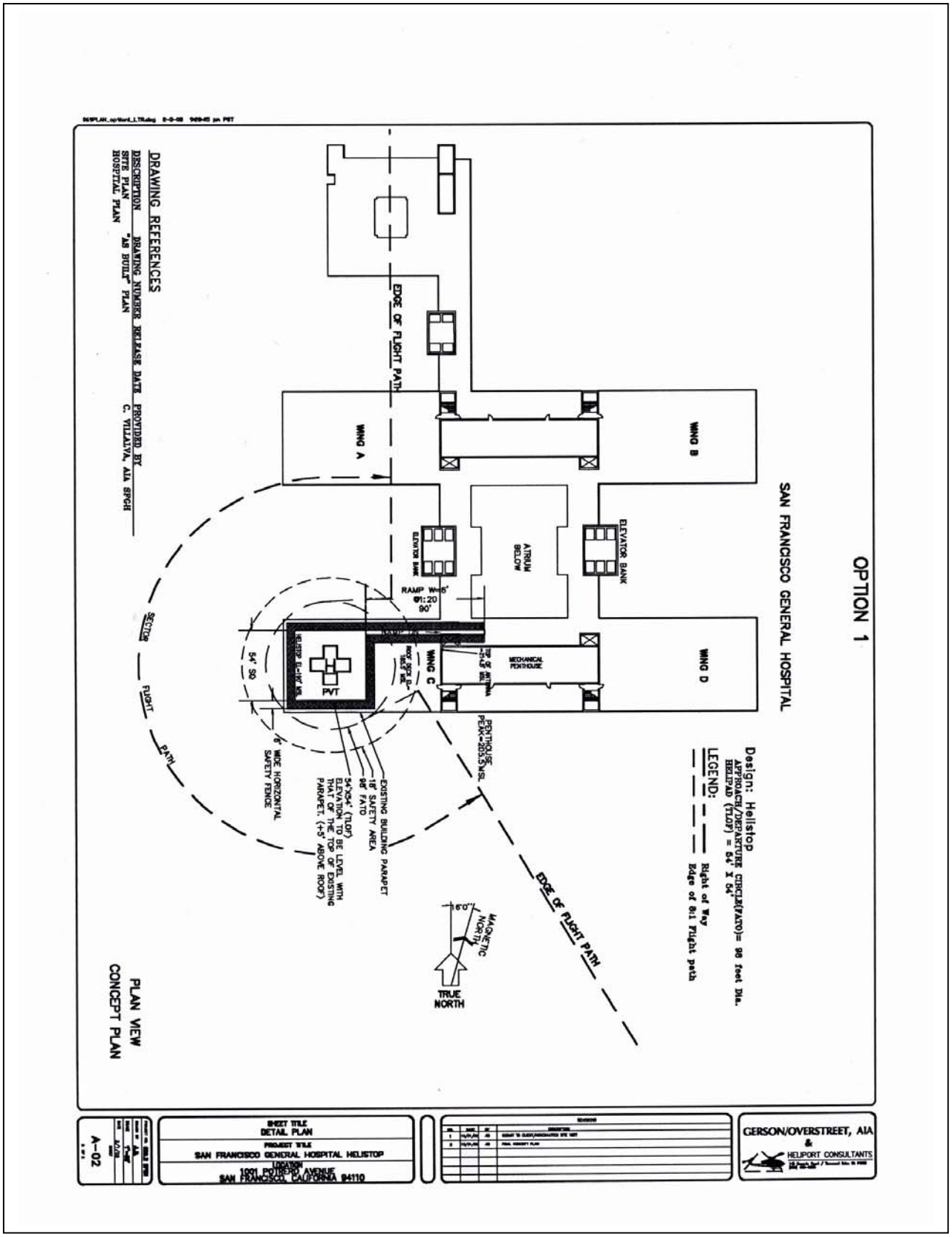


Figure 4-6 Alternative 1 Site Plan

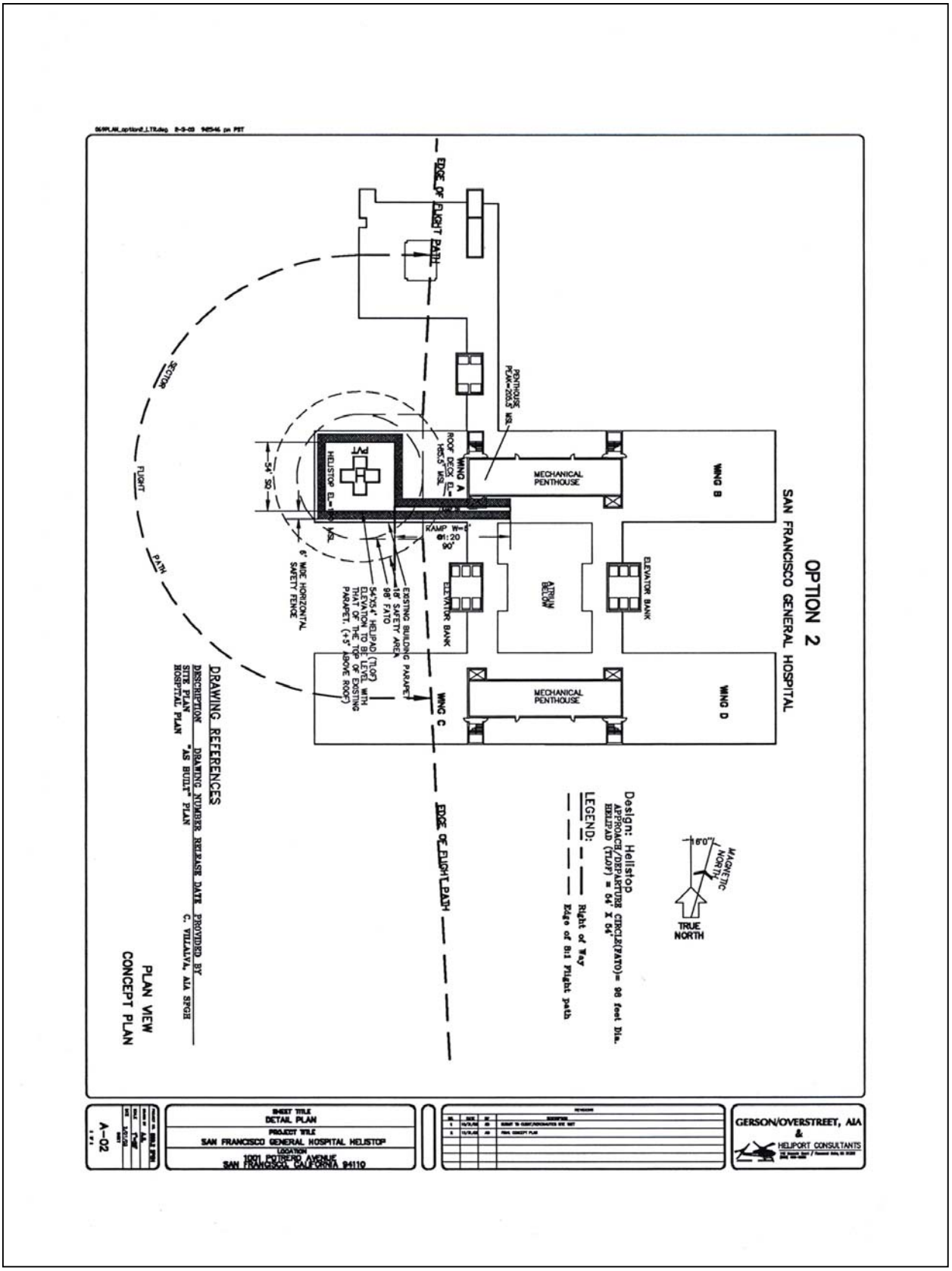


Figure 4-7 Alternative 2 Site Plan

Code Requirements

The design and construction of a helipad on the roof must conform to the structural regulations of Title 24, Part 2, Division VI-R, of the California Building Code as it pertains to acute care occupancies. If any changes to the live or dead loads of an existing hospital building cause an increase in story seismic shear force of more than 5%, then the building must meet or be retrofitted to meet the Life-safety or Seismic Performance Category 2, of Division VI-R.[2]

Building Description

The Main Hospital was designed by T. Y. Lin, Kulka Yang and Associates, in 1969, prior to the implementation of the 1973 Hospital Seismic Safety Act. The main building has about 550,000 square feet of area. The Main Hospital is a concrete shear wall building consisting of a six-story tower on a two-story base and a single story basement. The floor plan of the tower is H-shaped, and is symmetric. The gravity load-resisting system of the building includes post-tensioned floor slabs, beams, and reinforced concrete framing. The lateral force-resisting system is comprised of concrete walls located around the stair shafts, elevator shafts, and exterior walls. The columns and walls are supported on spread footings or drilled piers at the foundation level.

Assumptions

Degenkolb evaluated the feasibility of a new helipad of plan dimensions 54 feet by 54 feet on the roof of the northwest and southwest wings. To assess the increase in seismic forces that would be associated with this addition, Degenkolb assumed the pad to be constructed with a five-inch deep, light weight concrete fill on 3 inch metal deck. Steel beams and girders spanning to steel columns in the mid-dle of the helipad and to the exterior concrete walls on the exterior would support the metal deck. The new steel columns would be located directly on top of the existing interior concrete columns.

[2] Ibid.

The average weight of this system is 80 psf. The helicopter design load was 18,000 pounds, which corresponds to a Bell 412 helicopter take-off load. The helipad would be braced against seismic forces with diagonal steel braces between the landing pad and the existing concrete roof.

Conclusions

Based on the system described above, the additional weight of the helipad would not increase the seismic forces in the top story by more than 5 percent. Therefore, the addition would not cause a regulatory requirement to strengthen the building for seismic forces. The new system itself must be designed for seismic forces in accordance with Section 1632A of CBC 2001 – "*Lateral Forces on Elements of Structures, Nonstructural Components and Equipment Supported by Structures.*"[3]

Degenkolb noted that there is a second option that was not investigated at this time but should be considered if the project moves forward. The second option would be to provide a prefabricated aluminum framing system with a proprietary helipad surface. The proprietary helipad package includes the framing, non-skid surface, ramps, and lights. The estimated average weight of the proprietary system would be about 30 psf. This system might be easier to install on the roof than the steel framed concrete deck described above. Not only is the proprietary system lighter and therefore, presumably easier to hoist onto the roof, the system would not require placing concrete at the roof level.[4]

ELEVATOR REQUIREMENTS

The Otis Elevator Company reviewed the existing elevator hoist way plans with respect to providing two elevators for roof top helipad access.[5] The proposed elevator upgrade would provide rooftop access for medical personnel to a future helipad on the existing hospital building to allow for the efficient transport of injured patients to the hospital's Emergency department.

[3] Ibid.
[4] Ibid.
[5] Otis Elevator Company, Memorandum:Heliport Project, February 7, 2003.

Otis determined that the elevators were installed in 1972 and have remained largely unchanged since their installation 30 years ago. The elevators were found to be in average condition, and have several components at the end of their useful life. Any project that reconfigures the existing elevators may have significant cost associated with upgrades of the subsystems.[6]

Otis defined three basic scenarios to accomplish the objective of elevator access to the roof:[7]

A) Zone II – Raise two of the Zone II elevators approximately 3-1/2 feet and install two new landings at the roof elevation. This work posed two concerns. First, the existing machine slab structure is supported diagonally by steel beams that will require additional structural work to accommodate a new position. Second, the existing 11-foot overhead would be reduced to 71/2 feet. Code requires an 8-foot overhead. A Cal-OSHA variance would be required. Otis did not speculate on the likelihood of the issuance of a variance. Otis also recommended the modernization of the Zone II elevators. This work should be completed at the same time as the modification to provide roof top access.

B) Zone I – Raise two of the Zone I future elevators approximately 3-1/2 feet and install two new landings at the roof elevation. This elevator bank has two empty hoist ways. The slab structure is supported in a simple span and would require modest structural work to accommodate the new slab position. The future cars could be added to the existing bank of four elevators. The same overhead problem would exist in Zone I. The new elevators would be installed using state-of-the-art controls, SCR drive, ADA compliant fixtures, and state-of-the-art door operation. The new cabs would be built inside the existing hoist ways. The existing entrances and landing doors would be re-used.

C) Shuttle Elevator – Another possible scenario would be the installation of two new hole-less hy-

[6] Ibid.
[7] Ibid.

draulic elevators. The top landing would be on the roof and the bottom landing would be adjacent to the existing bank of elevators in Zone II. This is the most feasible scenario and would be the least expensive. The drawback here would be the necessity to transfer patients from the shuttles to the main Zone II elevators. The shuttle elevators would run at a speed of 125 feet per minute. Typical capacity for hydraulic elevators would be 2,500 pounds. The cabs would be designed to accommodate a gurney and additional personnel. Door operation would be single speed, center opening. In Otis's estimation, the use of the shuttles would add about 45 seconds to the total travel time to the Emergency Department.

Otis concluded that, option A would be the most expensive, but provided the most direct access to the operating rooms and emergency department. Option B would be somewhat less complex to install, but it would not provide direct access to the ED.. Option C would be the least expensive, but would impose additional patient transfer time.

PRELIMINARY COST ESTIMATES AND SCHEDULE

The total cost for the design, implementation, and construction of a rooftop helipad at either Site 1 or Site 2 at SFGH is estimated to be on the order of $3 million. This estimate does not include any seismic upgrades to the main hospital structure, which, by law, are required whether or not a helipad is constructed. The estimated costs[8] can be broken down as follow:

Phase I-Planning and Design

Project Design	$ 230,000
Environmental Review	$ 350,000
Permitting/Approvals	$ 120,000
Reimburseables	$ 25,000
Contingency/Other	$ 100,000
Subtotal	$ 825,000

[8] 2003 dollars (rounded).

Phase II-Construction

Helipad	$ 400,000
Ramp to Elevator	$ 80,000
Elevator Access	$ 630,000
Life safety/Security	$ 35,000
General Conditions	$ 570,000
Contingency/Other	$ 460,000
Subtotal	$2,175,000
Total Estimated Costs	**$3,000,000**

Timeline

It is anticipated that Phase I could take from 12 to 16 months to complete, including environmental review and permit processing. Phase II could be completed in less than one year.

HELIPAD PERMITTING PROCESS

The approval process for the helipad entails a review by federal, state and local agencies that have specific areas of responsibility. The following is an overview of this process.

Federal Government

The Federal Aviation Administration (FAA) is the federal agency that establishes standards for the design of the helipad, and the rules for pilot and helicopter operations. The FAA's primary responsibility is to determine what if any effect the landing and taking off of helicopters will have on the air traffic in the immediate vicinity of the proposed site. SFGH is located in San Francisco Airports – Class B airspace just beyond 7 nautical miles from the center point of the runway. SFGH is also in Class C airspace for Oakland Airport.

After an application is made to the FAA, it will make a site visit to determine if there are any obstructions at or near the site and whether the proposed flight operations would interfere with the existing air traffic in the area. Upon completion of the airspace study, the FAA will issue a letter of determination.

State Government

The State of California's agency that issues the final heliport permit is the Division of Aeronautics (DOA)within the Department of Transportation (Caltrans). This agency reviews all the documentation and approvals submitted from the local government agencies and the FAA.

The Division will not issue a heliport permit, without which the proponent could not conduct flight operations, unless the helistop plans and the proposed flight paths meet the criteria for safety specified in the FAA Advisory Circular – AC 150/5390/2A, "*Heliport Design*."

The Office of Statewide Health Planning and Development (OSHPD) enforces building standards as published in the California Building Standards codes as it relates to health facilities construction. They will also review the proposed plans.

Helipad Operating Permit. Once the helipad construction is completed, the DOA inspector will come to the site for a final inspection. If the pad was built according to the approved plans, the DOA will be able to issue the final operating permit to SFGH. Each year the DOA performs a compliance site inspection on the heliport.

City and County of San Francisco

The local government requirements focus on the zoning and planning considerations, building codes, and fire regulations. They have no jurisdiction over the airspace or helipad design requirements.

P District – Zone. SFGH is located within a "P" District zone where public structures and uses of the City and County of San Francisco and other governmental agencies are allowed under the municipal code as long as they are in conformity with the San Francisco General Plan. According to the Planning Department, a helipad would be a use in keeping with the medical mission of a Level 1 Trauma Center and is consistent with the San Francisco General Plan and local ordinances.

Environmental Review. In addition to reviewing all the submittals for compliance with the City and County of San Francisco Municipal Code, the City planning staff will

also evaluate the documents for compliance with California Environmental Quality Act (CEQA), as amended. As the "Lead Agency" in the helistop permitting process, the Planning Department will have the principle responsibility for coordinating the environmental review process and ultimately submitting the documents to the State Clearinghouse.

Figure 4-8 illustrates the Building Permit Process, which in this zone is the appropriate process for obtaining local and community approval for the construction of the SFGH helipad. The environmental review process will either take the form of a Mitigated Negative Declaration or a focused Environmental Impact Report (EIR) depending upon the initial Planning Department evaluation. This may be a lengthy process, on the order of 8 to 12 months, during which the project will be carefully evaluated.

This current study, which explores the feasibility of the helipad at different locations along with the professed need for a helipad at the SFGH Trauma Center, would serve as a basis for the initial planning review and scoping meetings. During all phases of the process, there will be opportunities for community input.

Helipad Plan Development. The approval of the plans for the helipad is a major part of the approval process. At the same time the environmental review process is progressing, the helipad plans will be developed in order to allow OSHPD time to comment on them for inclusion in the final report.

Site Plan Permit/ Building Permit. When the environmental review has been approved, the City will be able to issue a Site Plan Permit. This document, along with the approved plans, which have been reviewed for design and safety compliance by the various state and city agencies, will be submitted to the Division of Aeronautics for their "Site Approval Permit." The state DOA will issue this permit if all the documents are in order from local and federal agencies.

At this point, SFGH would be able to obtain a Building Permit, which would allow for the construction of the helipad. During the construction process, OSHPD will be reviewing the helipad development