Section 5: Earthquake Hazards in the City of Long Beach

Why Are Earthquakes a Threat to the City of Long Beach?

The most recent significant earthquake event affecting southern California was the January 17th 1994 Northridge Earthquake. At 4:31 A.M. on Monday, January 17, a moderate but very damaging earthquake with a magnitude of 6.7 struck the San Fernando Valley. In the following days and weeks, thousands of aftershocks occurred, causing additional damage to affected structures.

57 people were killed and more than 1,500 people seriously injured. For days afterward, thousands of homes and businesses were without electricity; tens of thousands had no gas; and nearly 50,000 had little or no water. Approximately 15,000 structures were moderately to severely damaged, which left thousands of people temporarily homeless. 66,500 buildings were inspected. Nearly 4,000 were severely damaged and over 11,000 were moderately damaged. Several collapsed bridges and overpasses created commuter havoc on the freeway system. Extensive damage was caused by ground shaking, but earthquake triggered liquefaction and dozens of fires also caused additional severe damage. This extremely strong ground motion in large portions of Los Angeles County resulted in record economic losses.

However, the earthquake occurred early in the morning on a holiday. This circumstance considerably reduced the potential effects. Many collapsed buildings were unoccupied, and most businesses were not yet open. The direct and indirect economic losses ran into the 10's of billions of dollars.

The City of Long Beach is situated in the southern portion of the Los Angeles Basin. The Los Angeles Basin is a depositional basin that has been filled with clastic sediments for the last fifteen million years. The basin was opened by the tectonic forces of the Pacific plate moving against the North American plate. The primary tear in the rocks that marks this boundary is the San Andreas Fault (transform fault). The break is not just one simple tear but occurs in a broad swath across southern California that includes several right lateral strike slip faults. The tectonic plate movements are shared by these faults. One of the faults, the Newport-Inglewood Fault diagonally crosses Long Beach. It was on this fault that the famous long beach Earthquake of 1933 occurred. This fault is still considered the most probable source for an earthquake in the Long Beach area. The California Geological Survey has estimated that an earthquake of Magnitude 7.0 is credible on the Newport-Inglewood Fault in the Long Beach area. Because of this, residents of Long Beach must expect to feel earthquakes. These earthquakes can be very destructive. California Geological Survey Special Bulletin 99 details an earthquake scenario for an earthquake that occurs in Long Beach. Damage to Long Beach and the infrastructure are estimated.

The history of fault activity in Long Beach is more complex than just the Newport-Inglewood Fault. This is evident by the oil fields in Long Beach. The Long Beach, Airport, Recreation Park and Seal Beach oil fields occur along the

Newport-Inglewood Fault. The super-giant Wilmington oil field occurs between the Newport-Inglewood Fault and the Palos Verdes Fault. Each oil field is formed by rock deformations caused by the faulting. Each oil field has numerous faults. Only the faults within the Newport-Inglewood fault zone are considered active (movement within the last 11,000 years). The Palos Verdes Fault, just offshore of Long Beach, may be active but it has not been designated so by the California Geological Survey. The many faults within the Wilmington oil field are not considered active and have not shown any activity in the Holocene (11,000 years). The areas of active faulting have been designated by the California Geological Survey (Special Publication 42) as fault hazard areas and are subject to detailed investigation prior to development. The Earthquake Fault Zones for Long Beach are indicated on the Long Beach and Seal Beach Quadrangles as issued by the California Geological Survey. The evaluation work is administered by the City of Long Beach through the Planning and Building Department. Investigations are performed by geotechnical consultants retained by the developers and reviewed and approved by a representative of the Planning and Building Department. Actual site inspections of the investigations are performed by a Registered Geologist or a Certified Engineering Geologist representing Long beach. The reports are filed at the City of Long Beach for reference.

Historical and geological records show that California has a long history of seismic events. Southern California is probably best known for the San Andreas Fault, a 400 mile long fault running from the Mexican border to a point offshore, west of San Francisco. "Geologic studies show that over the past 1,400 to 1,500 years large earthquakes have occurred at about 130 year intervals on the southern San Andreas Fault. As the last large earthquake on the Southern San Andreas occurred in 1857, that section of the fault is considered a likely location for an earthquake within the next few decades."[1]

But San Andreas is only one of dozens of known earthquake faults that crisscross southern California. Some of the better known faults include the Newport-Inglewood, Whittier-Narrows, Chatsworth, Elsinore, Hollywood, Los Alamitos, Puente Hills, and Palos Verdes Faults. Beyond the known faults, there are a potentially large number of "blind" faults that underlie the surface of southern California. One such blind fault was involved in the 1987 Whittier Narrows Earthquake.

Although the most famous of the faults, the San Andreas, is capable of producing an earthquake with a magnitude of 8+ on the Richter Scale, some of the "lesser" faults have the potential to inflict an even greater damage on the urban core of the Los Angeles Basin. Seismologists believe that a 6.0 earthquake on the Newport-Inglewood fault would result in far more death and destruction than a "great" quake on the San Andreas, because the San Andreas is relatively remote from the urban centers of southern California. The Newport-Inglewood Fault, on the other hand, runs along the or near the coastline of Los Angeles and Orange Counties and directly through the heart of Long Beach.

The rupture of this fault was the cause of the 1933 Long Beach Earthquake that killed 115 people.

For decades, partnerships have flourished between the USGS, Cal Tech, the California Geological Survey and universities to share research and educational efforts with Californians. Tremendous earthquake mapping and mitigation efforts have been made in California in the past two decades, and public awareness has risen remarkably during this time. Major federal, state, and local government agencies and private organizations support earthquake risk reduction, and have made significant contributions in reducing the adverse impacts of earthquakes. Despite the progress, the majority of California communities remain unprepared because there is a general lack of understanding regarding earthquake hazards among Californians.

Table 5-1: Earthquake Events in the Southern California Region

Southern California Region Earthquakes with a Magnitude 5.0 or Greater			
1769	Los Angeles Basin	1916	Tejon Pass Region
1800	San Diego Region	1918	San Jacinto
1812	Wrightwood	1923	San Bernardino Region
1812	Santa Barbara Channel	1925	Santa Barbara
1827	Los Angeles Region	1933	Long Beach
1855	Los Angeles Region	1941	Carpenteria
1857	Great Fort Tejon Earthquake	1952	Kern County
1858	San Bernardino Region	1954	W. of Wheeler Ridge
1862	San Diego Region	1971	San Fernando
1892	San Jacinto or Elsinore Fault	1973	Point Mugu
1893	Pico Canyon	1986	North Palm Springs
1894	Lytle Creek Region	1987	Whittier Narrows
1894	E. of San Diego	1992	Landers
1899	Lytle Creek Region	1992	Big Bear
1899	San Jacinto and Hemet	1994	Northridge
1907	San Bernardino Region	1999	Hector Mine
1910	Glen Ivy Hot Springs		

Source:
http://geology.about.com/gi/dynamic/offsite.htm?site=http%3A%2F%2Fpasadena.wr.usgs.gov%2Finfo%2Fcahist_eqs.html

To better understand the earthquake hazard, the scientific community has looked at historical records and accelerated research on those faults that are the

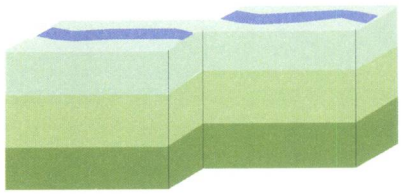
sources of the earthquakes occurring in the southern California region. Historical earthquake records can generally be divided into records of the pre-instrumental period and the instrumental period. In the absence of instrumentation, the detection of earthquakes is based on observations and felt reports, and is dependent upon population density and distribution. Since California was sparsely populated in the 1800s, the detection of pre-instrumental earthquakes is relatively difficult. However, two very large earthquakes, the Fort Tejon in 1857 (7.9) and the Owens Valley in 1872 (7.6) are evidence of the tremendously damaging potential of earthquakes in southern California. In more recent times two 7.3 earthquakes struck southern California, in Kern County (1952) and Landers (1992). The damage from these four large earthquakes was limited because they occurred in areas which were sparsely populated at the time they happened. The seismic risk is much more severe today than in the past because the population at risk is in the millions, rather than a few hundred or a few thousand persons.

History of Earthquake Events in Southern California

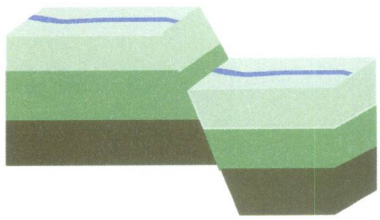
Since seismologists started recording and measuring earthquakes, there have been tens of thousands of recorded earthquakes in southern California, most with a magnitude below three. No community in southern California is beyond the reach of a damaging earthquake. Figure 5-1 describes the historical earthquake events that have affected southern California.

Figure 5-1: Causes and Characteristics of Earthquakes in Southern California

Earthquake Faults
A fault is a fracture along between blocks of the earth's crust where either side moves relative to the other along a parallel plane to the fracture.

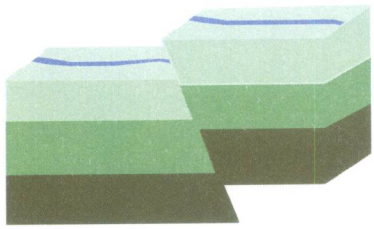


Strike-slip
Strike-slip faults are vertical or almost vertical rifts where the earth's plates move mostly horizontally. From the observer's perspective, if the opposite block looking across the fault moves to the right, the slip style is called a right lateral fault; if the block moves left, the shift is called a left lateral fault.



Dip-slip

Dip-slip faults are slanted fractures where the blocks mostly shift vertically. If the earth above an inclined fault moves down, the fault is called a normal fault, but when the rock above the fault moves up, the fault is called a reverse fault. Thrust faults have a reverse fault with a dip of 45 ° or less.



Dr. Kerry Sieh of Cal Tech has investigated the San Andreas Fault at Pallett Creek. "The record at Pallett Creek shows that rupture has recurred about every 130 years, on average, over the past 1500 years. But actual intervals have varied greatly, from less than 50 years to more than 300. The physical cause of such irregular recurrence remains unknown." [2] Damage from a great quake on the San Andreas would be widespread throughout Southern California.

Earthquake Related Hazards

Ground shaking, landslides, liquefaction, and amplification are the specific hazards associated with earthquakes. The severity of these hazards depends on several factors, including soil and slope conditions, proximity to the fault, earthquake magnitude, and the type of earthquake.

Ground Shaking

Ground shaking is the motion felt on the earth's surface caused by seismic waves generated by the earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and distance from the epicenter (where the earthquake originates). Buildings on poorly consolidated and thick soils will typically see more damage than buildings on consolidated soils and bedrock.

Earthquake-Induced Landslides

Earthquake-induced landslides are secondary earthquake hazards that occur from ground shaking. They can destroy the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Many communities in southern California have a high likelihood of encountering such risks, especially in areas with steep slopes.

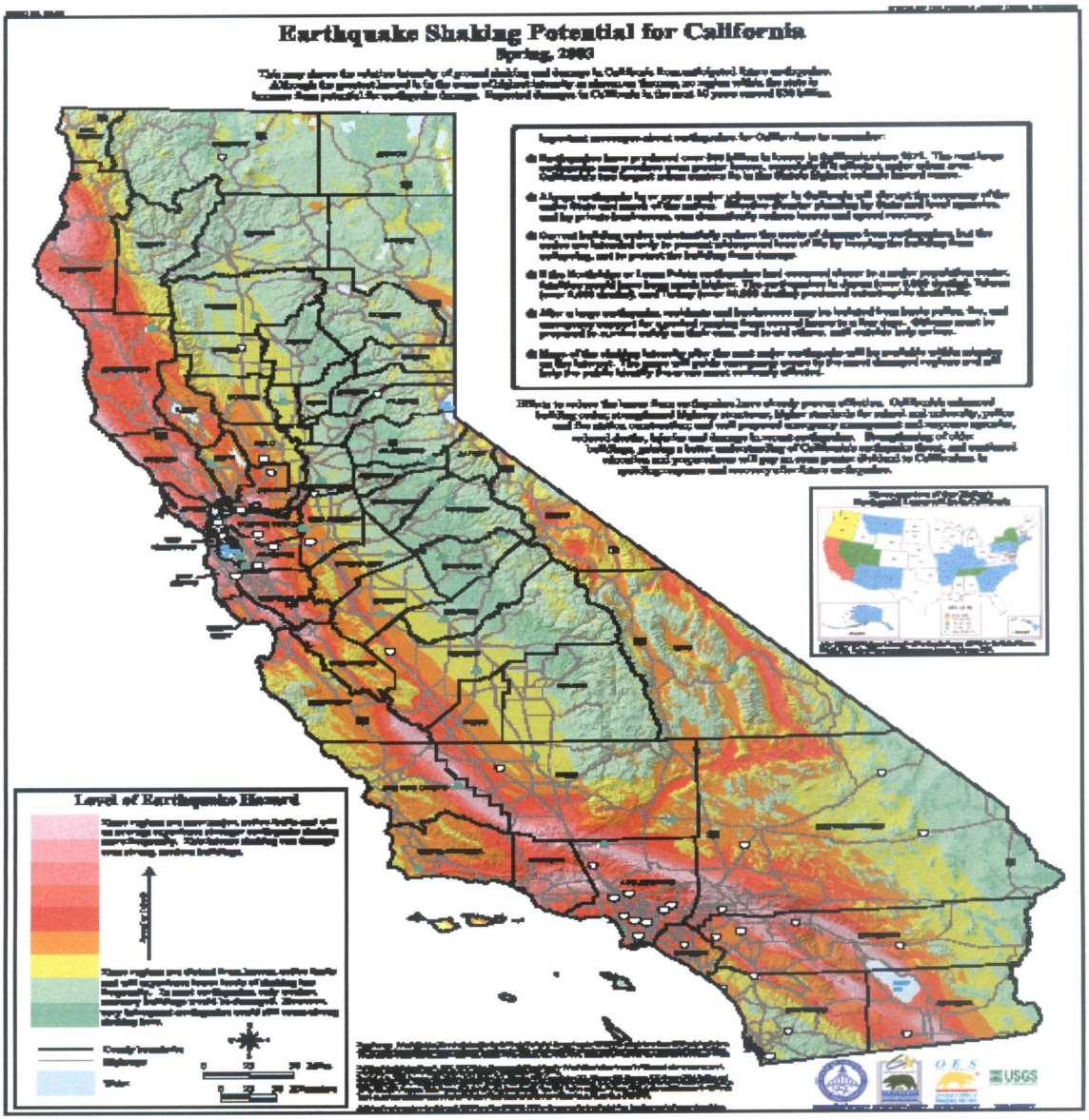
Liquefaction

Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures. Many communities in southern California are built on ancient river bottoms and have sandy soil. In some cases this ground may be subject to liquefaction, depending on the depth of the water table.

Amplification

Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by the thickness of geologic materials and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk.[3] Amplification can also occur in areas with deep sediment filled basins and on ridge tops.

Map 5-1: Seismic Zones in California
(Source: State of California)



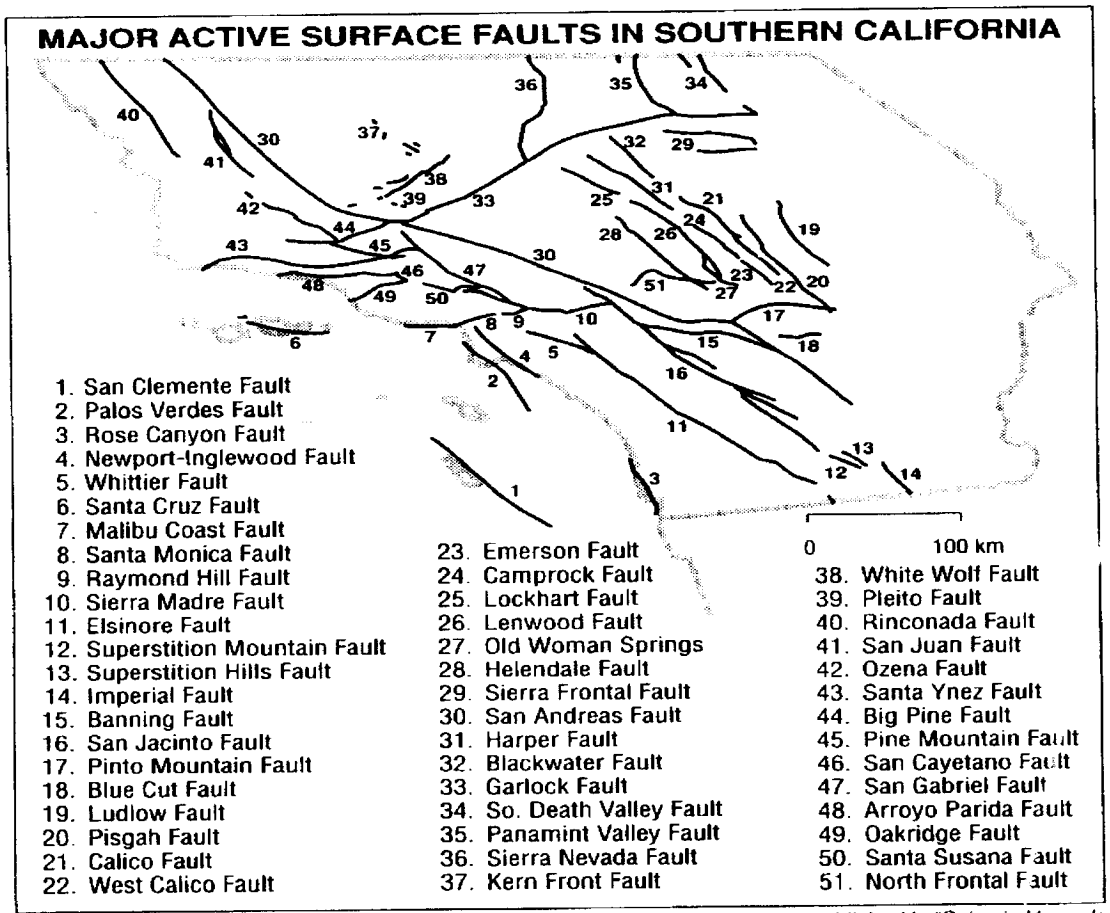
Earthquake Hazard Assessment

Hazard Identification

In California, many agencies are focused on seismic safety issues: the State's Seismic Safety Commission, the Applied Technology Council, Governor's Office of Emergency Services, United States Geological Survey, Cal Tech, the California Geological Survey as well as a number of universities and private foundations.

These organizations, in partnership with other state and federal agencies, have undertaken a rigorous program in California to identify seismic hazards and risks including active fault identification, bedrock shaking, tsunami inundation zones, ground motion amplification, liquefaction, and earthquake induced landslides. Seismic hazard maps have been published and are available for many communities in California through the State Division of Mines and Geology. Map 5-2 illustrates the known earthquake faults in southern California.

Map 5-2: Major Active Surface Faults in Southern California (Source: City's Multi-Hazard Functional Plan)



Source: Adapted from the map of major active Southern California surface faults published in "Seismic Hazards in Southern California: Probable Earthquakes, 1994-2024," Southern California Earthquake Center.

In California, each earthquake is followed by revisions and improvements in the Building Codes. The 1933 Long Beach Earthquake resulted in the Field Act, affecting school construction. The 1971 Sylmar Earthquake brought another set of increased structural standards. Similar re-evaluations occurred after the 1989 Loma Prieta Earthquake and 1994 Northridge Earthquake. These Code changes have resulted in stronger and more earthquake resistant structures.

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. This state law was a direct result of the 1971 San Fernando Earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. Surface rupture is the most easily avoided seismic hazard.[4]

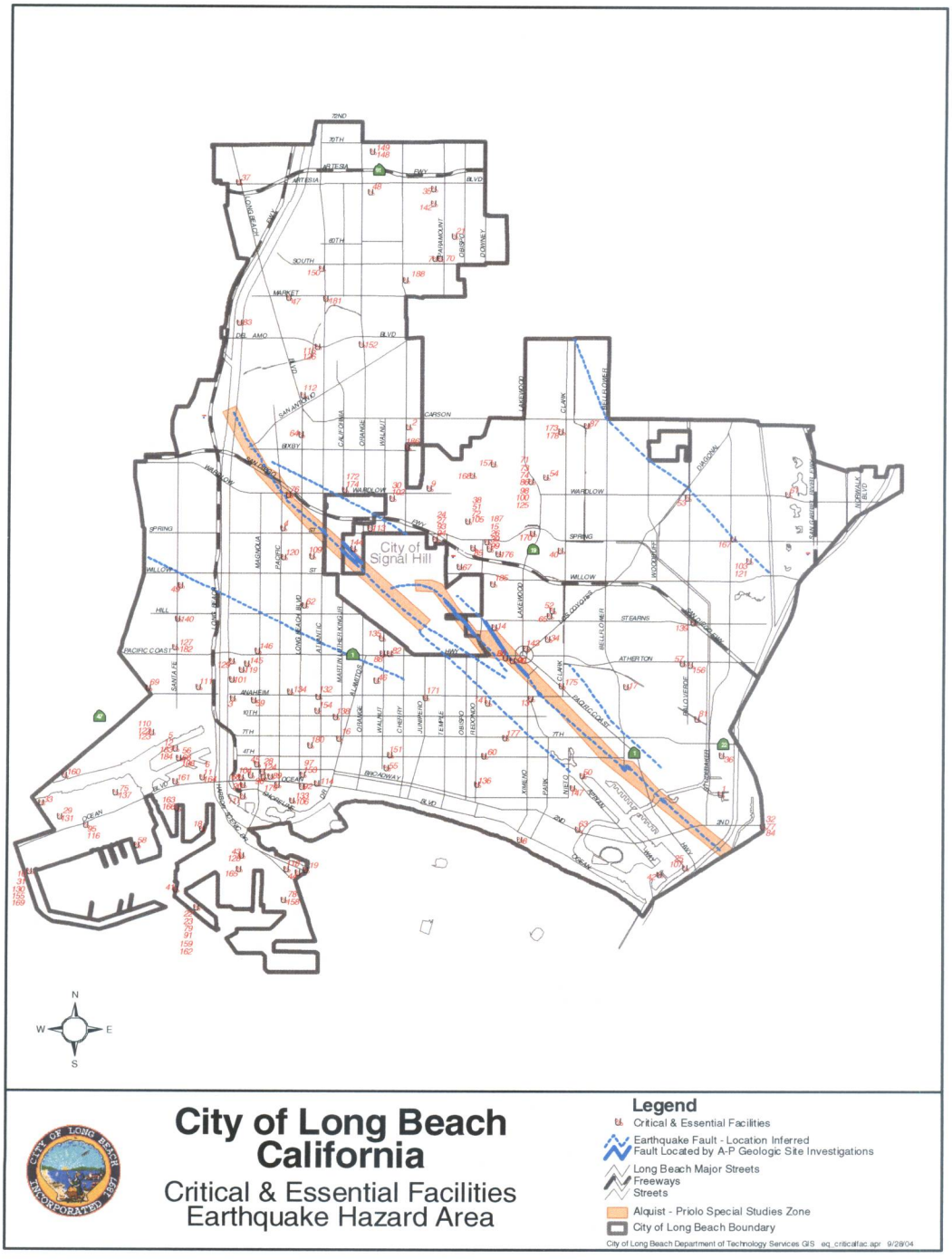
The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides.[5] The State Department of Conservation operates the Seismic Mapping Program for California. Extensive information is available at their website: http://gmw.consrv.ca.gov/shmp/index.htm

Vulnerability Assessment

The effects of earthquakes span a large area, and large earthquakes occurring in many parts of the southern California region would probably be felt throughout the region. However, the degree to which the earthquakes are felt, and the damages associated with them may vary. At risk from earthquake damage are large stocks of old buildings and bridges: many high tech and hazardous materials facilities: extensive sewer, water, and natural gas pipelines; earth dams; petroleum pipelines; and other critical facilities and private property located in the county. The relative or secondary earthquake hazards, which are liquefaction, ground shaking, amplification, and earthquake-induced landslides, can be just as devastating as the earthquake.

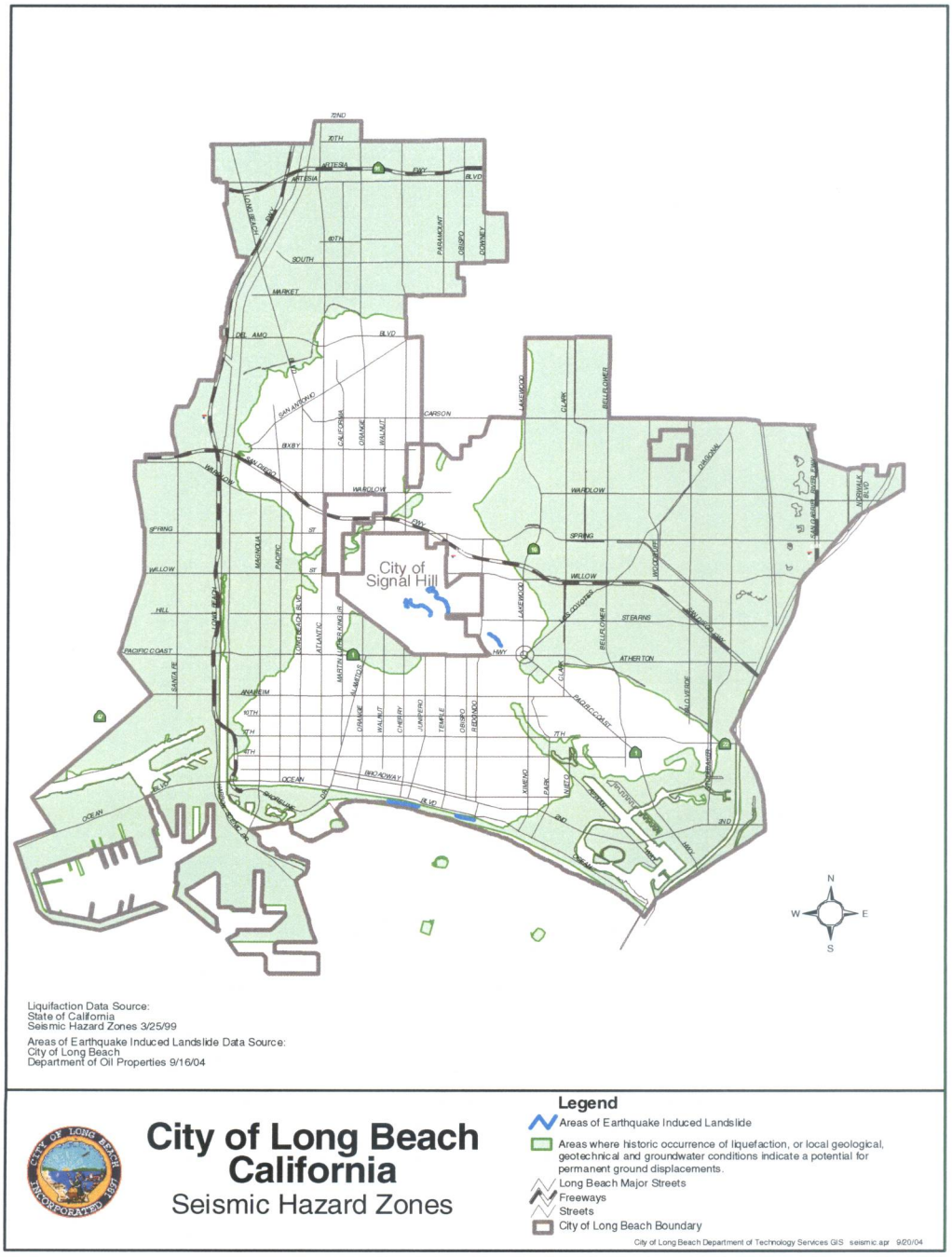
The California Geological Survey has identified areas most vulnerable to liquefaction. Liquefaction occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. This results in the loss of soil strength and the soil's ability to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures.

Map 5-3 Earthquake Faults in the City of Long Beach
(Source: City of Long Beach General Plan – Public Safety Element/GIS)



The City has liquefaction zones as shown on Map 5-4: Liquefaction and EQ-Induced Landslide Area in the City of Long Beach. The majority of the City is susceptible to damages from liquefaction.

Map 5-4: Seismic Hazard Zones in Long Beach
(Source: City of Long Beach)



Southern California has many active landslide areas, and a large earthquake could trigger accelerated movement in these slide areas, in addition to jarring loose other unknown areas of landslide risk.

Risk Analysis

Risk analysis is the third phase of a hazard assessment. Risk analysis involves estimating the damage and costs likely to be experienced in a geographic area over a period of time[6]. Factors included in assessing earthquake risk include population and property distribution in the hazard area, the frequency of earthquake events, landslide susceptibility, buildings, infrastructure, and disaster preparedness of the region. This type of analysis can generate estimates of the damages to the region due to an earthquake event in a specific location. FEMA's software program, HAZUS, uses mathematical formulas and information about building stock, local geology and the location and size of potential earthquakes, economic data, and other information to estimate losses from a potential earthquake.[7] The HAZUS software is available from FEMA at no cost.

For greater southern California there are multiple worst case scenarios, depending on which fault might rupture, and which communities are in proximity to the fault. But damage will not necessarily be limited to immediately adjoining communities. Depending on the hypocenter of the earthquake, seismic waves may be transmitted through the ground to unsuspecting communities. In the Northridge 1994 Earthquake, Santa Monica suffered extensive damage, even though there was a range of mountains between it and the origin of the earthquake.

Damages for a large earthquake almost anywhere in southern California are likely to run into the billions of dollars. Although building codes are some of the most stringent in the world, ten's of thousands of older existing buildings were built under much less rigid codes. California has laws affecting unreinforced masonry buildings (URM's) and although many building owners have retrofitted their buildings, hundreds of pre-1933 buildings still have not been brought up to current standards.

In the 1980's, the City of Long Beach began a program to compel owners to retrofit their unreinforced masonry building. Of the original 936, only five buildings are not yet retrofitted.

Non-structural bracing of equipment and contents is often the most cost-effective type of seismic mitigation. Inexpensive bracing and anchoring may be the most cost effective way to protect expensive equipment. Non-structural bracing of equipment and furnishings will also reduce the chance of injury for the occupants of a building.

Community Earthquake Issues

What is Susceptible to Earthquakes?

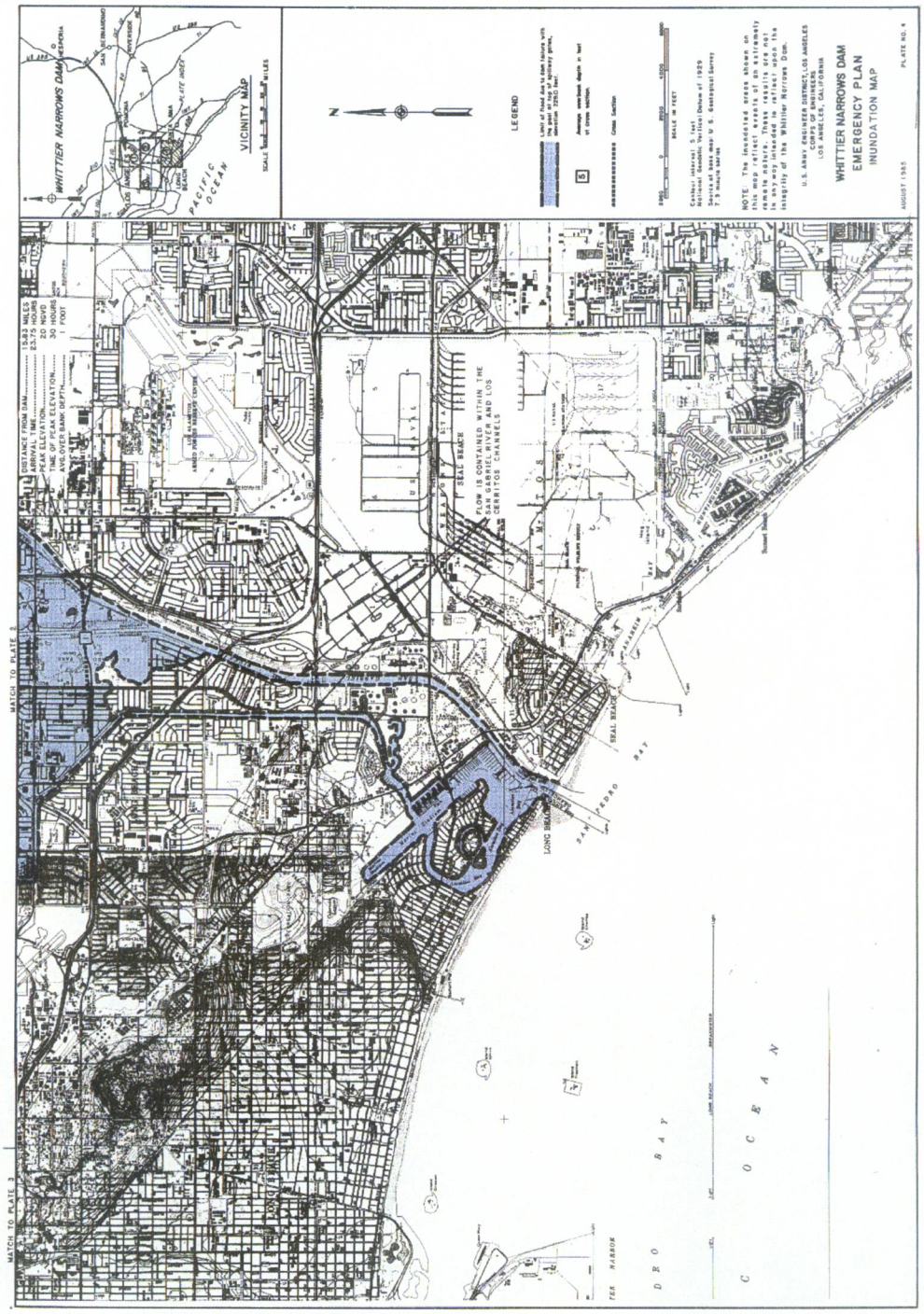
Earthquake damage occurs because humans have built structures that cannot withstand severe shaking. Buildings, airports, schools, and lifelines (highways and utility lines) suffer damage in earthquakes and can cause death or injury to humans. The welfare of homes, major businesses, and public infrastructure is very important. Addressing the reliability of buildings, critical facilities, and infrastructure, and understanding the potential costs to government, businesses, and individuals as a result of an earthquake, are challenges faced by the city.

Dams

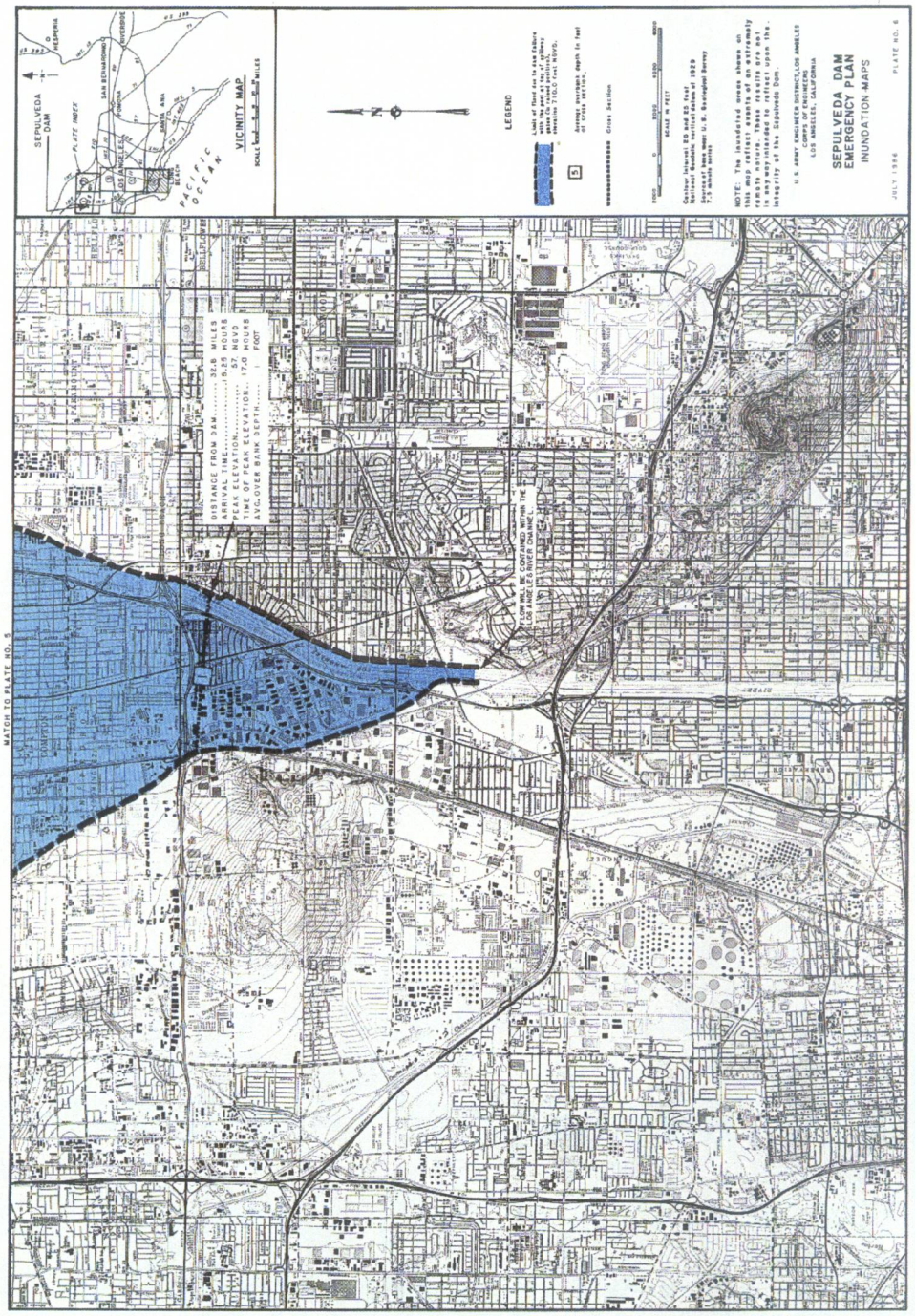
There are a total of 103 dams in Los Angeles County, owned by 23 agencies or organizations, ranging from the Federal government to Homeowner's Associations.[8] These dams hold billions of gallons of water in reservoirs. Releases of water from the major reservoirs are designed to protect Southern California from flood waters and to store domestic water. Seismic activity can compromise the dam structures, and the resultant flooding could cause catastrophic flooding. Following the 1971 Sylmar Earthquake the Lower Van Norman Dam showed imminent signs of structural compromise, and came within several feet of being overtopped and/or breached. Tens of thousands of persons had to be evacuated until the dam could be drained. The dam has never been refilled.

According to the City's General Plan Public Safety Element, three flood control dams lie upstream from the City: Sepulveda Basin, Hansen Basin, and Whittier Narrows Basin. The Sepulveda and Hansen Basins lie more than 30 miles upstream from where the Los Angeles River passes through the City. Due to the intervening low and flat ground and the distance involved, flood waters resulting from a dam failure at either of these locations would be expected to dissipate before reaching Long Beach. In the event of failure of the Whittier Narrows Dam while full, flooding could occur along both sides of the San Gabriel River where it passes through Long Beach but would probably be most severe on the east side of the river channel. Due to river flow, the probability of flooding as a result of seismically induced failure of these structures is considered to be very low.

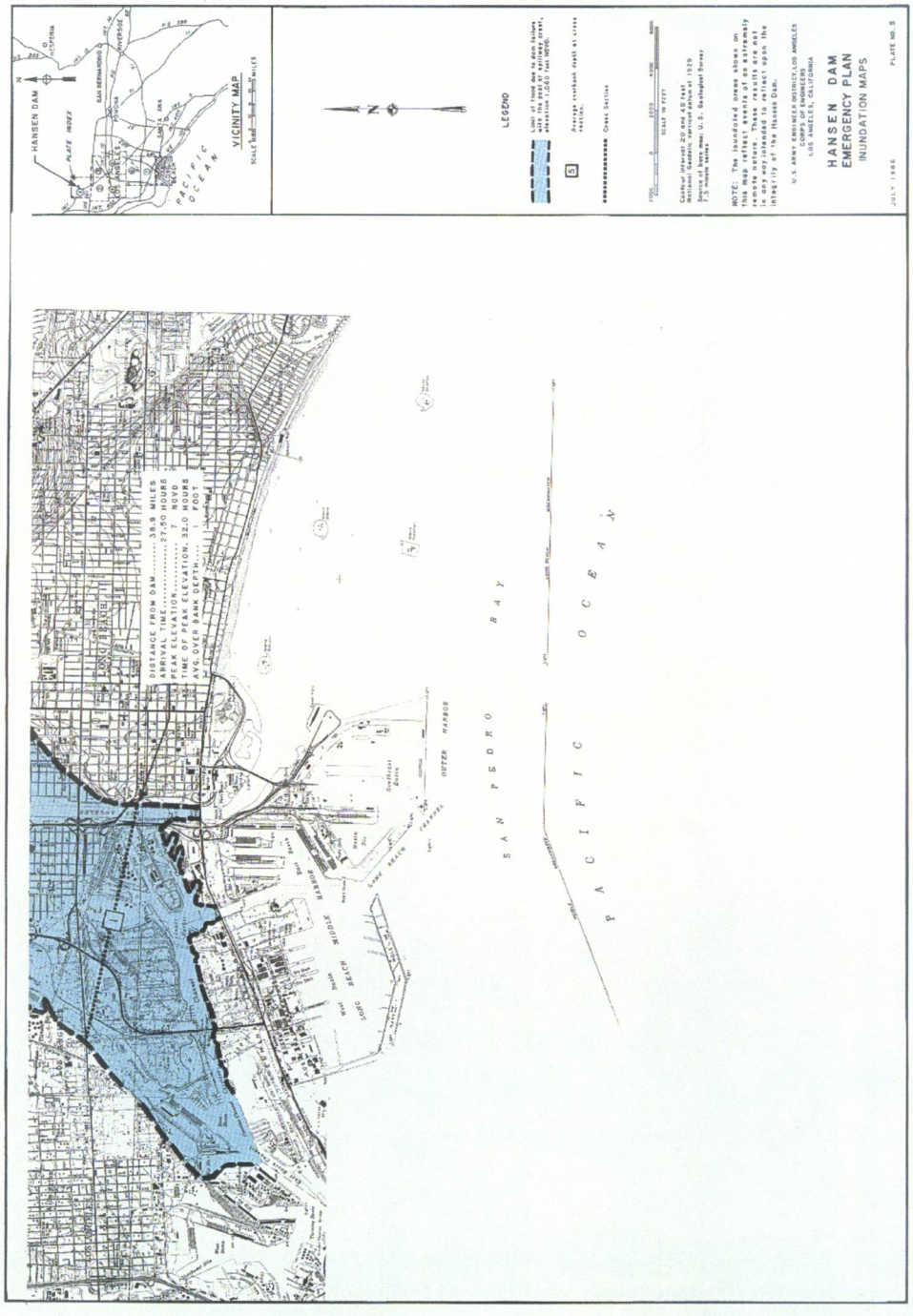
Map 5-5: Whittier Narrows Dam Failure Inundation Map
(Source: U.S. Army Corps of Engineers)



Map 5-6: Sepulveda Dam Failure Inundation Map
(Source: U.S. Army Corps of Engineers)



Map 5-7: Hansen Dam Failure Inundation Map
(Source: U.S. Army Corps of Engineers)



Buildings

The built environment is susceptible to damage from earthquakes. Buildings that collapse can trap and bury people. Lives are at risk and the cost to clean up the damages is great. In most California communities, including the City of Long Beach, many buildings were built before 1993 when building codes were not as strict. In addition, retrofitting is not required except under certain conditions and can be expensive. Therefore, the number of buildings at risk remains high. The California Seismic Safety Commission makes annual reports on the progress of the retrofitting of unreinforced masonry buildings.

Infrastructure and Communication

Residents in the City commute frequently by automobiles and public transportation such as buses and light rail. An earthquake can greatly damage bridges and roads, hampering emergency response efforts and the normal movement of people and goods. Damaged infrastructure strongly affects the economy of the community because it disconnects people from work, school, food, and leisure, and separates businesses from their customers and suppliers.

Bridges

Bridges are key points of concern during flood events because they are important links in road networks, river crossings, and they can be obstructions in watercourses, inhibiting the flow of water during flood events. The bridges in the City of Long Beach are state, county, city, or privately owned. A state-designated inspector must inspect all state, county, and city bridges every two years; but private bridges are not inspected, and can be very dangerous.

The inspections are rigorous, looking at everything from seismic capability to erosion and scour.

The highest priority bridges in the City of Long Beach are currently being upgraded by replacing the earthquake resistant bearing pads using county funds. These bridges include:

Table 5-2: Major Road Bridges of Los Angeles County

Bridge	City	Year Built	Span
Vincent Thomas Bridge	Los Angeles	1964	6,500 Ft.
Gerald Desmond Bridge	Long Beach	1968	5,134 Ft.
Commodore Schuyler F. Heim Lift Bridge	Long Beach	1946	3,976 Ft.

Bridge Damage
Even modern bridges can sustain damage during earthquakes, leaving them unsafe for use. Some bridges have failed completely due to strong ground motion. Bridges are a vital transportation link - with even minor damages making some areas inaccessible. Because bridges vary in size, materials, location and design, any given earthquake will affect them differently. Bridges built before the mid-1970' s have a significantly higher risk of suffering structural damage during a moderate to large earthquake compared with those built after 1980 when design improvements were made.

Much of the interstate highway system was built in the mid to late 1960's. The bridges in the City are state, county or privately owned (including railroad bridges). Caltrans has retrofitted most bridges on the freeway systems; however there are still some county maintained bridges that are not retrofitted. The FHWA requires that bridges on the National Bridge Inventory be inspected every 2 years. Caltrans checks when the bridges are inspected because they administer the Federal funds for bridge projects. See Section 5: Earthquake Attachments for details on bridge retrofitting efforts.

Damage to Lifelines
Lifelines are the connections between communities and outside services. They include water and gas lines, transportation systems, electricity, and communication networks. Ground shaking and amplification can cause pipes to break open, power lines to fall, roads and railways to crack or move, and radio and telephone communication to cease. Disruption to transportation makes it especially difficult to bring in supplies or services. Lifelines need to be usable after earthquake to allow for rescue, recovery, and rebuilding efforts and to relay important information to the public.

Disruption of Critical Services
Critical facilities include police stations, fire stations, hospitals, shelters, and other facilities that provide important services to the community. These facilities and their services need to be functional after an earthquake event. Many critical facilities are housed in older buildings that are not up to current seismic codes. See Risk Assessment – Attachment 1 for a table showing critical and essential facilities vulnerable to earthquakes.

Businesses
Seismic activity can cause great loss to businesses, both large-scale corporations and small retail shops. When a company is forced to stop production for just a day, the economic loss can be tremendous, especially when its market is at a national or global level. Seismic activity can create economic loss that presents a burden to large and small shop owners who may have difficulty recovering from their losses.

Forty percent of businesses do not reopen after a disaster and another twenty-five percent fail within one year according to the Federal Emergency Management Agency (FEMA). Similar statistics from the United States Small Business Administration indicate that over ninety percent of businesses fail within two years after being struck by a disaster.[9]

Individual Preparedness
Because the potential for earthquake occurrences and earthquake related property damage is relatively high in the City of Long Beach, increasing individual preparedness is a significant need. Strapping down heavy furniture, water heaters, and expensive personal property, as well as being earthquake insured, and anchoring buildings to foundations are just a few steps individuals can take to prepare for an earthquake.

Death and Injury
Death and injury can occur both inside and outside of buildings due to collapsed buildings falling equipment, furniture, debris, and structural materials. Downed power lines and broken water and gas lines can also endanger human life.

Fire
Downed power lines or broken gas mains may trigger fires. When fire stations suffer building or lifeline damage, quick response to extinguish fires is less likely. Furthermore, major incidents will demand a larger share of resources, and initially smaller fires and problems will receive little or insufficient resources in the initial hours after a major earthquake event. Loss of electricity may cause a loss of water pressure in some communities, further hampering fire-fighting ability.

Debris
After damage to a variety of structures, much time is spent cleaning up bricks, glass, wood, steel or concrete building elements, office and home contents, and other materials. Developing a strong debris management strategy is essential in post-disaster recovery. Disasters do not exempt the City from compliance with AB 939 regulations.

Existing Mitigation Activities
Existing mitigation activities include current mitigation programs and activities that are being implemented by county, regional, state, or federal agencies or organizations.

City of Long Beach Codes
Implementation of earthquake mitigation policy most often takes place at the local government level. The City of Long Beach Department of Planning and Building enforces building codes pertaining to earthquake hazards.

The following sections of the California Building Code (CBC) address the earthquake hazard:

1605.2.1 (Distribution of Horizontal Shear);
1605.2.2 (Stability against Overturning);
1605.2.3 (Anchorage); and
1626-1635 (Earthquake Design);

The City of Long Beach Department of Planning and Building enforces the zoning and land use regulations relating to earthquake hazards.

Generally, these codes seek to discourage development in areas that could be prone to flooding, landslide, wildfire and/or seismic hazards; and where development is permitted, that the applicable construction standards are met. Developers in hazard-prone areas may be required to retain a qualified professional engineer to evaluate level of risk on the site and recommend appropriate mitigation measures

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Coordination among Building Officials
The City's Building Code sets the minimum design and construction standards for new buildings. On September 12, 2002, the City adopted the most recent seismic standards in its building code, which requires that new buildings be built at a higher seismic standard.

Since the mid-1980's, the City of Long Beach has required that site-specific seismic hazard investigations be performed for new essential facilities, major structures, hazardous facilities, and special occupancy structures such as schools, hospitals, and emergency response facilities.

Businesses/Private Sector
Natural hazards have a devastating impact on businesses. In fact, of all businesses which close following a disaster, more than 43% never reopen, and an additional twenty-nine percent close for good within the next two years.[10] The Institute of Business and Home Safety has developed "Open for Business", which is a disaster planning toolkit to help guide businesses in preparing for and dealing with the adverse affects natural hazards. The kit integrates protection from natural disasters into the company's risk reduction measures to safeguard employees, customers, and the investment itself. The guide helps businesses secure human and physical resources during disasters, and helps to develop strategies to maintain business continuity before, during, and after a disaster occurs.

Hospitals
"The Alfred E. Alquist Hospital Seismic Safety Act ("Hospital Act") was enacted in 1973 in response to the moderate Magnitude 6.6 1971 Sylmar Earthquake when four major hospital campuses were severely damaged and evacuated. Two hospital buildings collapsed killing forty seven people. Three others were killed in another hospital that nearly collapsed.

In approving the Act, the Legislature noted that: "Hospitals, that house patients who have less than the capacity of normally healthy persons to protect themselves, and that must be reasonably capable of providing services to the public after a disaster, shall be designed and constructed to resist, insofar as practical, the forces generated by earthquakes, gravity and winds." (Health and Safety Code Section 129680)

When the Hospital Act was passed in 1973, the State anticipated that, based on the regular and timely replacement of aging hospital facilities, the majority of hospital buildings would be in compliance with the Act's standards within 25 years. However, hospital buildings were not, and are not, being replaced at that anticipated rate. In fact, the great majority of the State's urgent care facilities are now more than 40 years old.

The moderate Magnitude 6.7 Northridge Earthquake in 1994 caused $3 billion in hospital-related damage and evacuations. Twelve hospital buildings constructed

before the Act were cited (red tagged) as unsafe for occupancy after the earthquake. Those hospitals that had been built in accordance with the 1973 Hospital Act were very successful in resisting structural damage. However, nonstructural damage (for example, plumbing and ceiling systems) was still extensive in those post-1973 buildings.

Senate Bill 1953 ("SB 1953"), enacted in 1994 after the Northridge Earthquake, expanded the scope of the 1973 Hospital Act. Under SB 1953, all hospitals are required, as of January 1, 2008, to survive earthquakes without collapsing or posing the threat of significant loss of life. The 1994 Act further mandates that all existing hospitals be seismically evaluated, and retrofitted, if needed, by 2030, so that they are in substantial compliance with the Act (which requires that the hospital buildings be reasonably capable of providing services to the public after disasters). SB 1953 applies to all urgent care facilities (including those built prior to the 1973 Hospital Act) and affects approximately 2,500 buildings on 475 campuses.

SB 1953 directed the Office of Statewide Health Planning and Development ("OSHPD"), in consultation with the Hospital Building Safety Board, to develop emergency regulations including "...earthquake performance categories with sub gradations for risk to life, structural soundness, building contents, and nonstructural systems that are critical to providing basic services to hospital inpatients and the public after a disaster." (Health and Safety Code Section 130005)

The Seismic Safety Commission Evaluation of the State's Hospital Seismic Safety Policies

In 2001, recognizing the continuing need to assess the adequacy of policies, and the application of advances in technical knowledge and understanding, the California Seismic Safety Commission created an Ad Hoc Committee to re-examine the compliance with the Alquist Hospital Seismic Safety Act. The formation of the Committee was also prompted by the recent evaluations of hospital buildings reported to OSHPD that revealed that a large percentage (40%) of California's operating hospitals are in the highest category of collapse risk.".[11]

California Earthquake Mitigation Legislation

California is painfully aware of the threats it faces from earthquakes. Dating back to the 19th Century, Californians have been killed, injured, and lost property as a result of earthquakes. As the State's population continues to grow, and urban areas become even more densely developed, the risk will continue to increase. For decades the legislature has passed laws to strengthen the built environment and protect the citizens. Table 5-2 provides a sampling of some of the 200 plus laws in the State's codes.

Table 5-3: Partial List of the Over 200 California Laws on Earthquake Safety

Government Code Section 8870-8870.95	Creates Seismic Safety Commission.
Government Code Section 8876.1-8876.10	Established the California Center for Earthquake Engineering Research.
Public Resources Code Section 2800-2804.6	Authorized a prototype earthquake prediction system along the Central San Andreas Fault near the City of Parkfield.
Public Resources Code Section 2810-2815	Continued the Southern California Earthquake Preparedness Project and the Bay Area Regional Earthquake Preparedness Project.
Health and Safety Code Section 16100-16110	The Seismic Safety Commission and State Architect, will develop a state policy on acceptable levels of earthquake risk for new and existing state-owned buildings.
Government Code Section 8871-8871.5	Established the California Earthquake Hazards Reduction Act of 1986.
Health and Safety Code Section 130000-130025	Defined earthquake performance standards for hospitals.
Public Resources Code Section 2805-2808	Established the California Earthquake Education Project.
Government Code Section 8899.10-8899.16	Established the Earthquake Research Evaluation Conference.
Public Resources Code Section 2621-2630 2621.	Established the Alquist-Priolo Earthquake Fault Zoning Act.
Government Code Section 8878.50-8878.52 8878.50.	Created the Earthquake Safety and Public Buildings Rehabilitation Bond Act of 1990.
Education Code Section 35295-35297 35295.	Established emergency procedure systems in kindergarten through grade 12 in all the public or private schools.
Health and Safety Code Section 19160-19169	Established standards for seismic retrofitting of unreinforced masonry buildings.
Health and Safety Code Section 1596.80-1596.879	Required all child day care facilities to include an Earthquake Preparedness Checklist as an attachment to their disaster plan.
Source: http://www.leginfo.ca.gov/calaw.html	

Earthquake Education

Earthquake research and education activities are conducted at several major universities in the Southern California region, including Cal Tech, USC, UCLA, UCSB, UCI, and UCSB. The local clearinghouse for earthquake information is the Southern California Earthquake Center located at the University of Southern California, Los Angeles, CA 90089, Telephone: (213) 740-5843, Fax: (213) 740-0011, Email: SCEinfo@usc.edu, Website: http://www.scec.org. The Southern California Earthquake Center (SCEC) is a community of scientists and specialists who actively coordinate research on earthquake hazards at nine core institutions, and communicate earthquake information to the public. SCEC is a National Science Foundation (NSF) Science and Technology Center and is co-funded by the United States Geological Survey (USGS).

In addition, Los Angeles County along with other southern California counties, sponsors the Emergency Survival Program (ESP), an educational program for

learning how to prepare for earthquakes and other disasters. Many school districts have very active emergency preparedness programs that include earthquake drills and periodic disaster response team exercises.

End Notes

[1] http://pubs.usgs.gov/gip/earthq3/when.html

[2] http://www.gps.caltech.edu/~sieh/home.html

[3] Planning for Natural Hazards: The California Technical Resource Guide, Department of Land Conservation and Development (July 2000)

[4] http://www.consrv.ca.gov/CGS/rghm/ap/

[5] Ibid

[6] Burby, R. (Ed.) Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities (1998), Washington D.C., Joseph Henry Press.

[7] FEMA HAZUS http://www.fema.gov/hazus/hazus2.htm (May 2001).

[8] Source: Los Angeles County Public Works Department, March 2004

[9] http://www.chamber101.com/programs_committee/natural_disasters/DisasterPreparedness/Forty.htm

[10] Institute for Business and Home Safety Resources (April 2001),

[11] http://www.seismic.ca.gov/pub/CSSC_2001-04_Hospital.pdf

Attachment 5-1: Bridge Seismic Retrofit Request

COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone: (626) 458-5100
www.ladpw.org

JAMES A. NOYES, Director

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

May 23, 2002

IN REPLY PLEASE REFER TO FILE: PD-2

The Honorable Board of Supervisors
County of Los Angeles
383 Kenneth Hahn Hall of Administration
500 West Temple Street
Los Angeles, CA 90012

Dear Supervisors:

REQUEST FOR JURISDICTION
BRIDGE SEISMIC RETROFIT PROGRAM
WILLOW STREET OVER COYOTE CREEK
CITY OF LONG BEACH
SUPERVISORIAL DISTRICT 4
4 VOTES

IT IS RECOMMENDED THAT YOUR BOARD:

Find that the project to retrofit the bridge on Willow Street over Coyote Creek to seismic structural standards is exempt from the California Environmental Quality Act, and adopt the enclosed Resolution declaring the portion of Willow Street over Coyote Creek in the City of Long Beach to be a part of the County System of Highways.

PURPOSE/JUSTIFICATION OF RECOMMENDED ACTION

Jurisdiction is requested in order that the County may administer a project to retrofit the bridge on Willow Street over Coyote Creek to seismic structural standards. Willow Street at this location is jurisdictionally shared between the Cities of Long Beach and Los Alamitos. Sections 1700-1702 of the California Streets and Highways Code provide that the board of supervisors of any county may, by a resolution adopted by a four-fifths vote of its members, declare any highway in the county lying in whole or part within a city to be a county highway.

The governing body of the affected city may consent to the establishment of such included portion as part of the county highway system. Thereafter, the board of supervisors of the county may acquire rights of way, construct, maintain, improve, or repair such highway in the same manner as other county highways, and may pay for such work with county funds.

Implementation of Strategic Plan Goals

This action meets the County's Strategic Plan Goal of Service Excellence. By retrofitting the bridge on Willow Street over Coyote Creek, residents of the County who travel on this bridge will benefit and their quality of life will be improved.

FISCAL IMPACT/FINANCING

Your Board's adoption of the enclosed Resolution will not directly result in any fiscal impact on the County. We will submit the project to your Board for approval to advertise a construction contract for the seismic retrofit improvements in August 2002. It should be noted that this project will be constructed as a Federal-aid project under the State Seismic Retrofit Program administered by the State of California. Under this program, the entire cost of the project will be financed with Federal and State funds. Funding for this project will be included in the proposed Fiscal Year 2002-03 Road Fund Budget.

FACTS AND PROVISIONS/LEGAL REQUIREMENTS

The Resolution has been approved as to form by County Counsel.

ENVIRONMENTAL DOCUMENTATION

The California Environmental Quality Act requires public agency decision makers to document and consider the environmental implications of their actions. The proposed project is statutorily exempt from the provisions of the California Environmental Quality Act pursuant to Section 21080 (b) (4) of the Public Resources Code and Section 180.2 of the Streets and Highways Code.

IMPACT ON CURRENT SERVICES (OR PROJECTS)

Following the Loma Prieta earthquake in the San Francisco Bay Area in October 1989, emergency State legislation known as Senate Bill 36X was enacted, which requires that all existing publicly-owned bridges in the State be inspected and that those found to have a seismic structural deficiency be upgraded and retrofitted to conform with specific structural standards. The bill further provides for the County of Los Alamitos to be the lead agency for inspecting and retrofitting all non-State highway bridges within Los Angeles County.

Willow Street is on the County's Highway Plan, and the proposed improvements are needed and of general County interest. The project is tentatively scheduled to be advertised for construction bids in September 2002, pending the City's consent to jurisdiction and the County obtaining the necessary State and Federal approvals. A "no-fee" construction permit will be obtained from the City of Los Angeles for work within their jurisdiction.

This jurisdiction will be relinquished after the completion of the project.

CONCLUSION

Upon the adoption of this Resolution, please return one certified copy to Public Works for transmittal to the City.

Respectfully submitted,

JAMES A. NOYES
Director of Public Works

ESC:yr
CC12148
A:\WILLOW ST OVER COYOTE CK.wps

Enc.

cc: Chief Administrative Office, County Counsel

RESOLUTION DECLARING THE PORTION OF WILLOW STREET OVER COYOTE CREEK IN THE CITY OF LONG BEACH TO BE A PART OF THE COUNTY SYSTEM OF HIGHWAYS

WHEREAS, by reason of its location and travel thereon, the portion of Willow Street over Coyote Creek, within the City of Long Beach, County of Los Angeles, State of California, should be a part of the County System of Highways, for the limited purpose of performing a seismic safety retrofit of the bridge at the aforementioned location; and

WHEREAS, it is the purpose of the Board of Supervisors of said County to construct the above-stated improvements and perform appurtenant work thereon provided the consent of the governing body of the City shall first be given.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Supervisors of the County of Los Angeles, State of California, that the portion of Willow Street over Coyote Creek, within the City of Long Beach, is hereby declared to be a part of the System of Highways of said County as provided in Sections 1700 and 1704 inclusive of the Streets and Highways Code of the State of California for the purpose of, and limited to, the aforementioned work.

BE IT FURTHER RESOLVED, by the Board of Supervisors of the County of Los Angeles, State of California, that the County agrees:

1. That the County of Los Angeles shall not be responsible for any damage or liability occurring by reason of any roadway condition on the aforementioned street, within the City of Long Beach, existing prior to the start of construction by the County or following the completion and field acceptance of said construction.

2. That the work be performed by the County shall <u>not</u> include roadway maintenance activities on Willow Street over Coyote Creek, within the City of Long Beach, prior to the start of construction by the County or following the completion and field acceptance of said construction. The City of Long Beach shall be responsible for all roadway maintenance activities within its jurisdiction, except during the construction of improvements by the County.

The foregoing resolution was on the _____ day of _____, 2002, adopted by the Board of Supervisors of the County of Los Angeles and ex-officio the governing body of all other special assessment and taxing districts, agencies, and authorities for which said Board so acts.

VIOLET VARONA-LUKENS
Executive Officer of the
Board of Supervisors of the
County of Los Angeles

By_____
Deputy

APPROVED AS TO FORM:

LLOYD W. PELLMAN
County Counsel

By_____
Deputy

Attachment- 5-2: Seismic Retrofit Notice

August 15, 2002

NEWS -- Office of Supervisor Don Knabe
For release Aug. 20, subject to Board approval of Agenda Item 51
(Project I.D. No.CC6412)

For Immediate Release:

SEISMIC RETROFIT PLANNED FOR THE CITY OF LONG BEACH

SAN PEDRO (Aug. 20) -- Los Angeles County Supervisor Don Knabe announced plans to contract for seismic retrofitting of the Second Street bridge over the Alamitos Bay Channel in the City of Long Beach. This project is part of an ongoing program to retrofit city and county bridges to reduce the potential for failure during an earthquake.

This project is entirely within the City of Long Beach and will be constructed as a Federal-aid project under the State Seismic Retrofit Program. Under this program, the entire cost of the project will be financed with Federal and State funds.

Bids on a contract to perform the work will be opened September 17 by the County Department of Public Works. The project is expected to take 160 working days, starting in January and ending in August. Once work begins, two traffic lanes for each direction will be maintained at all times on Second Street.

####

4-6412TAP

Attachment 5-3: PWC Contracts Award

COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

"Enriching Lives"

JAMES A. NOYES, Director

900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone (626) 458-5100
www.ladpw.org

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

IN REPLY PLEASE
REFER TO FILE: C-1

December 30, 2003

The Honorable Board of Supervisors
County of Los Angeles
383 Kenneth Hahn Hall of Administration
500 West Temple Street
Los Angeles, CA 90012

Dear Supervisors:

AWARD OF PUBLIC WORKS CONSTRUCTION CONTRACTS
SUPERVISORIAL DISTRICTS 2 AND 4
3 VOTES

IT IS RECOMMENDED THAT YOUR BOARD:

Award and authorize the Director of Public Works or his designee to prepare the construction and maintenance services contracts in the form previously approved by County Counsel, execute the contracts, and establish the effective dates following receipt of approved Faithful Performance and Labor and Material bonds filed by the contractors for the following:

Project ID No. RDC0011416 - Carson Street Pedestrian Overcrossing at Long Beach City College, City of Long Beach (4), to PK Construction, in amount of $215,405.70.

Project ID No. RMD3246027 - Parkway Tree Planting, MD 3, 2003/04, vicinity of Baldwin Hills (2), to International Environmental Corporation, in amount of $94,495.88.

PURPOSE/JUSTIFICATION OF RECOMMENDED ACTION

We are recommending that your Board award these construction and maintenance services contracts and authorize the Director of Public Works or his designee to execute the contracts and establish the effective contract dates following receipt of approved bonds and insurance filed by contractors for each of these projects.

The enclosure for each project includes the project description, the call for bids and bid opening dates, a tabulation of bids, and financial information. The certified record of receipt of bids and the original bid proposals for each project are also enclosed, including addenda to the contract specifications for Project ID No. RMD3246027.

The recommended construction and maintenance services contracts are necessary to execute Board-directed and approved Public Works projects in support of operational missions. Your Board's approval of the recommended contract awards and our subsequent execution of the contracts will ensure the timely completion of the projects.

Implementation of Strategic Plan Goals

The award of these construction and maintenance services contracts is consistent with the County Strategic Plan Goal of Service Excellence since these contracts will provide improved infrastructure to better serve the public.

FISCAL IMPACT/FINANCING

The enclosure for each project includes the amount of the recommended contract as compared with the engineer's estimate and the other bids received.

These projects are included in the 2003-04 Department of Public Works Budget. The enclosure for each project includes more detailed fiscal and financial information.

FACTS AND PROVISIONS/LEGAL REQUIREMENTS

Recommended contract awards are to the lowest responsible bidders in accordance with the California Public Contract Code and your Board's directives.

On October 27, 1981, your Board adopted a program for the use of small Minority and Women-owned Businesses (MWBEs) on Federal- and State-funded highway construction contracts. Companies meeting these requirements are certified by the State as Disadvantaged Business Enterprises (DBEs). An overall goal for subcontracting portions of the work to DBEs is established for each project. Contracts are recommended for award to the lowest responsible bidder who meets the goal or documents a good faith effort to do so in conformance with the program.

We have also developed an outreach program to encourage all qualified contractors to participate in the bidding and contracting process on our projects. Under this program, we place notices of upcoming bids in local and minority newspapers throughout the County. These notices indicate that copies of plans and specifications are available at specified libraries and the Public Works Headquarters building. This allows interested contractors to view the plans and specifications at convenient locations. We also provide telephone numbers (including one for Spanish-speaking contractors) to obtain further information on bidding and subcontracting opportunities.

To further increase contractor awareness of contracting opportunities with Public Works, each of these projects was listed on the County website for upcoming bids.

The State Labor Code requires contractors to pay prevailing wage rates to all persons employed on public works construction contracts. These rates are determined by the Department of Industrial Relations and include contributions for fringe benefits such as vacations, pension funds, training, and health plans for each employee.

As required by your Board, language has been incorporated into the project specifications stating that the contractor shall notify its employees, and shall require each subcontractor to notify its employees, that they may be eligible for the Federal Earned Income Credit under the Federal income tax laws.

The contracts will be in the form previously approved by County Counsel. We will also review and approve the faithful performance and payment bonds filed by the contractors.

ENVIRONMENTAL DOCUMENTATION

Each of these projects was found to be categorically exempt from the provisions of the California Environmental Quality Act at the time your Board called for bids. The specifics of these findings are included in the enclosure for each project.

CONTRACTING PROCESS

The contracts were solicited on an open competitive basis in accordance with the provisions of the Public Contract Code.

The project specifications contain provisions requiring the contractor to report solicitations of improper consideration by County employees and allowing the County to terminate the contract if it is found that the contractor offered or gave improper consideration to County employees.

Public Works has confirmed that all of the respective contractors are in compliance with the County's Child Support Compliance Program and the requirements of the Contractor Employee Jury Service Program. In addition, the contracts will include language requiring compliance with the Newborn Abandonment Law (Safely Surrendered Baby Law).

The project specifications also contain a provision that, should the contractor require additional or replacement personnel to fill employment openings, consideration shall be given to hiring qualified participants in the County's Greater Avenues for Independence or General Relief Opportunities for Work Programs.

To ensure that the contracts are awarded to responsible contractors with satisfactory performance histories, bidders are required to report violations of the False Claims Act, their civil litigation history, and information regarding prior criminal convictions. The information reported by all of the respective contractors was considered before making this recommendation to approve execution of the contracts.

AWARD OF CONTRACT
December 30, 2003

PROJECT ID NO. RDC0011416, CARSON STREET PEDESTRIAN OVERCROSSING AT LONG BEACH CITY COLLEGE (City of Long Beach), Supervisorial District 4

TYPE OF WORK: Seismic retrofitting of the Carson Street Pedestrian Overcrossing bridge at Long Beach City College.

CALL FOR BIDS DATE: November 4, 2003 (Synopsis 56)

BID OPENING DATE: December 2, 2003

BID SUMMARY:

Low +*PK Construction 2126 North Fair Oaks Avenue Altadena, California 91001 (626) 794-0800		$215,405.70
2	Giffith Company	$239,195.60
3	*4-Con Engineering, Inc.	$268,796.50
4	Dalaj International Corp.	$269,261.00
5	Allied Building Contractors, Inc.	$272,062.00
6	GB Cooke, Inc.	$277,692.08
7	Excel Paving Company	$307,279.10
8	PPC Construction, Inc.	$290,929.00
9	T. T. Polich & Associates	$294,272.44
10	Metro Builders & Engineers Group, Inc.	$366,813.36

*MWBE
+SBE

FINANCIAL INFORMATION:

Amount of estimate	$199,338.24
Amount of recommended contract	$215,405.70
Amount of recommended contract above estimate	$ 16,067.46

The amount of the recommended contract is 8 percent above the estimate.

The project will be administered under the State Seismic Safety Retrofit Program as a Federal-Aid Project covered by Agreement 71078 with the State of California. Under this program, the entire cost of the project will be financed with Federal and State funds. This project is included in the Fiscal Year 2003-04 Road Fund Budget.

MINORITY/WOMEN-OWNED BUSINESS ENTERPRISE DATA:

PK Construction, an MBE, has no MWBE subcontractors/suppliers under this contract, yielding a proposed DBE participation of 100 percent. This contract has a Federal DBE goal of 9 percent.

ENVIRONMENTAL IMPACT:

This project is categorically exempt pursuant to Class 1, Subsection (x)(11), of the revised County Environmental Document Reporting Procedures and Guidelines adopted by your Board on November 17, 1987.

CONSTRUCTION SCHEDULE:

The contract specifications require the work to be completed in 40 working days. It is estimated that the work will start in March and be completed in April 2004.

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AWARD OF CONTRACT
December 30, 2003

PROJECT ID NO. RMD3246027, PARKWAY TREE PLANTING MD 3, 2003/04
(in the vicinity of Baldwin Hills), Supervisorial District 2

TYPE OF WORK: Planting of parkway trees.

CALL FOR BIDS DATE: November 4, 2003 (Synopsis 56)

BID OPENING DATE: December 2, 2003

BID SUMMARY:

Low	*International Environmental Corporation P.O. Box 4218 Panorama City, California 91412 (818) 892-9341	$ 94,495.88
2	*Azteca Landscape	$101,280.00
3	Reyco, Smith and Reynolds	$103,550.00
4	Pierre Sprinker and Landscape	$105,860.00
5	Tropical Creations, Inc.	$108,969.00
6	Travers Tree Service, Inc.	$117,845.00
7	Marina Landscape, Inc.	$121,800.00
8	*ABC Lawn Sprinkler, Co. Inc.	$136,496.00
9	American Landscape, Inc.	$145,586.50
10	West Coast Arborists, Inc.	$189,225.00
11	*Ryco Construction, Inc.	$315,400.00

*MWBE

FINANCIAL INFORMATION:

Amount of estimate	$123,225.00
Amount of recommended contract	$ 94,495.88
Amount of recommended contract below estimate	$ 28,729.12

The amount of the recommended contract is 23 percent below the estimate.

This project is included in the 2003-04 Road Fund Budget.