REPORT OF GEOLOGIC-SEISMIC HAZARDS EVALUATION FOR ENVIRONMENTAL IMPACT REPORT

PROPOSED HIGH-RISE OFFICE BUILDING AND RETAIL DEVELOPMENT
2000 AVENUE OF THE STARS
CENTURY CITY DISTRICT OF LOS ANGELES, CALIFORNIA

Prepared for:

TRAMMEL CROW SO.CAL., INC.

Los Angeles, California

November 13, 2001

Law/Crandall Project 70131-1-0242.0002

November 13, 2001

Mr. Kevin A. Lindquist
Trammel Crow So.Cal., Inc.
2049 Century Park East, Suite 2650
Los Angeles, California 90067

Subject: **Report of Geologic-Seismic Hazards Evaluation**
for Environmental Impact Report
Proposed High-Rise Office Building and Retail Development
2000 Avenue of the Stars
Century City District of Los Angeles, California
Law/Crandall Project 70131-1-0242.0002

Dear Mr. Lindquist:

We are pleased to submit our report of geologic-seismic hazards evaluation for use in preparing the environmental impact report for the proposed high-rise office building and retail development, to be located at 2000 Avenue of the Stars in the Century City District of Los Angeles, California. The scope of our work was performed in general accordance with our proposal dated February 27, 2001, authorized by you on May 31, 2001 and our change order dated November 6, 2001 authorized by you on November 8, 2001.

Please call if you have any questions or require additional information.

Sincerely,

LAW/CRANDALL
A Division of LAW Engineering and Environmental Services, Inc.

Susan F. Kirkgard
Senior Engineering Geologist

Perry Maljian
Principal Engineer
Senior Vice President

G:\Projects\70131 Geotech\10242 (2020 avenue of the stars)\Phase 0002\10242-0002.docsfk:tm
(3 copies submitted)

cc Mr. Travis Cullen
Envicom Corporation

REPORT OF GEOLOGIC-SEISMIC HAZARDS EVALUATION FOR ENVIRONMENTAL IMPACT REPORT

PROPOSED HIGH-RISE OFFICE BUILDING AND RETAIL DEVELOPMENT
2000 AVENUE OF THE STARS
CENTURY CITY DISTRICT OF LOS ANGELES, CALIFORNIA

Prepared for:

TRAMMEL CROW SO.CAL., INC.

Los Angeles, California

Law/Crandall, A Division of Law Engineering and Environmental Services, Inc.
Los Angeles, California

November 13, 2001

Law/Crandall Project 70131-1-0242.0002

TABLE OF CONTENTS

Page

LIST OF FIGURES iii

1.0 SCOPE 1

2.0 SITE CONDITIONS 1

3.0 PROPOSED DEVELOPMENT 2

4.0 GEOLOGIC AND SEISMIC CONDITIONS 2
- 4.1 GENERAL 2
- 4.2 GEOLOGIC MATERIALS 3
- 4.3 GROUND WATER 4
- 4.4 FAULTS 4
- 4.5 MINERAL RESOURCES 12
- 4.6 LANDFORM ALTERATION 12
- 4.7 GEOLOGIC-SEISMIC HAZARDS 12

5.0 CONCLUSIONS AND RECOMMENDATIONS 16
- 5.1 GENERAL 16
- 5.2 GEOLOGIC-SEISMIC IMPACTS 16
- 5.3 DESIGN/MITIGATION MEASURES 16
- 5.4 IMPACTS AFTER MITIGATION 17

6.0 BIBLIOGRAPHY 18

FIGURES

EARTHQUAKE DATABASE

LIST OF FIGURES

Figure

1 Local Geology

2 Regional Faults

3 Regional Seismicity

1.0 SCOPE

This report presents the results of our geologic-seismic hazards evaluation for the proposed high-rise office building and retail development in the Century City District of Los Angeles, California. The scope of our work was performed in general accordance with our proposals dated February 27, 2001 and November 6, 2001. Law/Crandall is concurrently providing geotechnical consultation services for the proposed development that include preparation of a comprehensive geotechnical report. At this time, a draft geotechnical report (dated October 5, 2001) has been submitted. The draft report will be finalized after additional structural information is provided by the project structural engineer.

The primary purpose of this study is to provide geologic-seismic information for incorporation into the Environmental Impact Report (EIR) planned to be filed for the proposed development. The results of our study are presented in this report. Our report is based on a review of previous geotechnical reports for the site and for other projects in the immediate area, and based on a review of available published and unpublished geologic and seismic literature pertinent to the study area. The Safety Element of the City of Los Angeles General Plan (1996) and the Seismic Safety Element of the County of Los Angeles General Plan (1990) were studied as part of our literature review. A list of the reports and documents we reviewed as part of our evaluation is included in Section 6.0, Bibliography.

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been prepared for Trammel Crow So. Cal., Inc. to be used solely in the preparation of an Environmental Impact Report for the proposed high-rise office building and retail development in the Century City District of Los Angeles, California. This report has not been prepared for use by other parties, and may not contain sufficient information for purposes of other parties or other uses.

2.0 SITE CONDITIONS

The project site is located in the Century City District of Los Angeles, California. It is located on the western half of a lot bounded by Avenue of the Stars to the west, Olympic Avenue to the south, Constellation Boulevard to the north, and Century Park East to the east. The project site is currently occupied by six-story buildings used for office and retail space, including a movie theater and performing arts theater. Two existing high-rise office buildings are located on the eastern half of the lot. A six-level subterranean parking structure underlies the entire lot.

The ground surface adjacent to the site is relatively level but slopes gently downward to the northeast. The concourse level of the project site (‘ground” or “at-grade” floor of the existing six-story buildings) is approximately at Elevation 280 feet. The floor of the lowest subterranean parking level is approximately at Elevation to 215 feet.

3.0 PROPOSED DEVELOPMENT

We understand that the existing movie theater and performing arts theater at the project site (2000 and 2020 Avenue of the Stars) will be demolished for the construction of a new proposed high-rise office building and two adjacent retail structures. The proposed high-rise building will be of steel-frame construction and have 13 stories of office space over two levels of retail space. The adjacent retail structures are expected to be of concrete construction and be up to three stories high. An existing six-level parking structure, which will remain in place, underlies the project site. The parking structure and existing overlying structures are supported on spread footings established below the lowest parking level. The proposed high-rise building will be supported on new columns extending through the existing parking structure. The proposed retail structures will be supported on existing columns.

4.0 GEOLOGIC AND SEISMIC CONDITIONS

4.1 GENERAL

The site is located on the northern portion of the Coastal Plain of Los Angeles County on a topographic rise between the City of Beverly Hills and the Westwood District of the City of Los Angeles. This topographic feature is generally referred to as the Beverly Hills (California Department of Water Resources, 1961). These hills represent the northern limit of the Newport-Inglewood uplift or fault zone that extends southeasterly from the Beverly Hills to offshore of Newport Beach. Regionally, the site is in the Peninsular Ranges geomorphic province that is characterized by elongate northwest-trending mountain ridges separated by straight-sided sediment-filled valleys. The northwest trend is further reflected in the direction of the dominant geologic structural features of the province that are northwest to west-northwest trending folds and faults, such as the nearby Newport-Inglewood fault zone located 1.8 kilometers to the east of the site.

The site is within the limits of Beverly Hills Oil Field (California Division of Oil, Gas, and Geothermal Resources, 1996). The Beverly Hills dome, which is a small fold developed at depth in Tertiary age sediments, is the northernmost anticlinal structure of the Newport-Inglewood uplift. The dome is apparently not reflected in overlying sediments of Pleistocene age. The limited production of the oil field is from a Mio-Pliocene age zone (at a depth of approximately 900 to 1,200 meters).

The relationship of the site to local geologic features is depicted in Figure 2, Local Geology, and the surface faults in the vicinity of the site are shown in Figure 3, Regional Faults. Figure 4, Regional Seismicity, shows the locations of major faults and earthquake epicenters in Southern California.

4.2 GEOLOGIC MATERIALS

Thirty-seven (37) borings were drilled at the site as part of our prior investigations in 1967 and 1969. Based on the materials encountered in our prior borings, artificial fill soils had mantled the site in 1967 and 1969. These fill soils were removed during construction of the existing theater buildings and parking structure. The project site is primarily underlain by late Pleistocene age older alluvial deposits (California Division of Mines and Geology, 1998). As encountered in our previous borings at the site, the alluvial deposits below the lowest parking level are primarily fine sand with varying amounts of gravel and cobbles. Hard cemented layers, up to 5 feet in thickness, were encountered at various depths below the lowest parking level. In the vicinity of the site, the late Pleistocene age alluvial deposits are between 15 and 26 meters (50 and 85 feet) thick, and are underlain by approximately 200 meters (650 feet) of early Pleistocene age sediments of the San Pedro Formation. The San Pedro Formation sediments are underlain by Tertiary age sedimentary rocks that are estimated to extend to a depth of approximately 4,000 meters (13,000 feet) beneath the site (Yerkes, 1965; California Department of Water Resources, 1961; Poland, 1959).

4.3 GROUND WATER

The site is located in Section 26 of Township 1 South, Range 15 West within the Santa Monica Hydrologic Subarea of the Los Angeles County Coastal Plain Hydrologic Subunit. Current ground-water level information for the site and the surrounding area is limited. The Los Angeles County Flood Control District's ground-water monitoring program ceased in about 1978. However, in recent years, the county has begun monitoring a select number of observation wells. Based on a review of available records, there are no nearby observation wells in the site vicinity to provide current ground-water level data.

According to the California Division of Mines and Geology (1998), the historic high ground-water level beneath the site ranges in depth from 9.1 to 12.2 meters (30 to 40 feet) beneath the existing ground surface. However, ground water was not encountered in the previous borings at the project site drilled to a maximum depth of approximately 13.7 meters (45 feet) below the lowest parking level. Ground water was also not encountered in the previous borings at the adjacent site of the Plaza Towers drilled to a maximum depth of 32 meters (105 feet) below the lowest parking level.

The current ground-water levels beneath the site could be different than those encountered during our previous investigations in 1967 and 1969. Additionally, zones of perched water could occur locally at higher elevations within the alluvial deposits beneath the site.

Although ground water was not encountered, water seepage was observed in several borings drilled within the project site and the adjacent Plaza Towers site. Within the project site, seepage was observed in two previous borings, approximately 1.5 meters (5 feet) above the bottom of the lowest parking level at Boring 23 from Job No. A-67065-B and at approximately 4.9 meters (16 feet) below ground surface in Boring 9 from Job No. A-67065. Water seepage was observed mostly near and above the lowest parking level in several borings at the adjacent Plaza Towers site. Although water seepage below the lowest parking level was not noted in most of the previous borings, the majority of borings extending to such depths were drilled using drilling mud that makes it difficult to establish ground water levels and areas of seepage.

4.4 FAULTS

The numerous faults in Southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Division of Mines and Geology (CDMG) for the Alquist-Priolo Earthquake Fault Zoning Program (Hart, 1997). By definition, an active fault is one that has had displacement within Holocene time (about the last 11,000 years). A potentially active fault is a fault that has demonstrated displacement of Quaternary age deposits (last 1.6 million years). Inactive faults have not moved in the last 1.6 million years. A list of nearby active faults and the distance in kilometers between the site and the nearest point on the fault, the maximum magnitude, and the slip rate for the fault is given in Table 1. A similar list for potentially active faults is presented in Table 2. The surface faults in the vicinity of the site are shown in Figures 2 and 3.

Table 1
Major Named Faults Considered to be Active in Southern California

Fault (in increasing distance)	Maximum Magnitude			Slip Rate (mm/yr.)	Distance From Site (kilometers)	Direction From Site
Santa Monica	6.6	(e)	RO	1.0	0.46	N
Newport-Inglewood Zone	6.9	(e)	SS	1.0	1.8	E
Hollywood	6.4	(e)	RO	1.0	3.2	N
Northridge Thrust	6.9	(e)	RO	1.5	10	NW
Malibu Coast	6.7	(e)	RO	0.3	11_	WSW
Compton-Los Alamitos Thrust	6.8	(e)	RO	1.5	12	SE
Verdugo	6.7	(e)	RO	0.5	18_	NNE
Elysian Park Thrust	6.7	(e)	RO	1.5	18_	ESE
Palos Verdes	7.1	(e)	SS	3.0	19	SW
Raymond	6.5	(e)	RO	0.5	23	ENE
San Fernando	6.7	(e)	RO	2.0	25	N
Sierra Madre	6.7	(e)	RO	2.0	26	NNE
Anacapa-Dume	7.3	(e)	RO	3.0	27	WSW
San Gabriel	7.0	(e)	SS	1.0	32	NNE
Whittier	6.8	(e)	SS	2.5	37	ESE
Simi-Santa Rosa	6.7	(e)	RO	1.0	38	NW
Oak Ridge	6.9	(e)	RO	4.0	49	NW
San Cayetano	6.8	(e)	RO	6.0	54	NW
San Andreas (Southern Segment)	7.4	(e)	SS	24.0	61	NE
Cucamonga	7.0	(e)	RO	5.0	63	ENE
San Jacinto (San Bernardino Segment)	6.7	(e)	SS	12.0	84	NE
Elsinore (Glen Ivy Segment)	6.8	(e)	SS	5.0	95	SE

(a) Slemmons, 1979
(b) Mark, 1977
(c) Blake, 1998
(d) Dolan et al., 1995
(e) CDMG, 1996
(f) Anderson, 1984
(g) Wesnousky, 1986
(h) Hummon et al., 1994
SS Strike Slip
NO Normal Oblique
RO Reverse Oblique

Table 2
Major Named Faults Considered to be Potentially Active
in Southern California

Fault (in increasing distance)	Maximum Magnitude			Slip Rate (mm/yr.)	Distance From Site (kilometers)	Direction From Site
Overland	6.0	(a)	SS	0.1	1.8	W
Charnock	6.5	(a)	SS	0.1	5.4	SSW
MacArthur Park	5.7	(h)	RO	3.0	10_	ENE
Coyote Pass	6.7	(b)	RO	0.1	19_	E
Northridge Hills	6.6	(g)	SS	1.2	20	N
Santa Susana	6.6	(e)	RO	5.0	29	NNW
Norwalk	6.7	(a)	RO	0.1	34	SE
Los Alamitos	6.2	(b)	SS	0.1	37	SE
Clamshell-Sawpit	6.5	(e)	RO	0.5	39	ENE
Duarte	6.7	(a)	RO	0.1	40	ENE
Holser	6.5	(e)	RO	0.4	48	NNW
Indian Hill	6.6	(b)	RO	0.1	52	E
Chino - Central Avenue	6.7	(e)	NO	1.0	64	E
Santa Cruz Island	6.8	(e)	RO	1.0	76	WSW
San Jose	6.5	(e)	RO	0.5	118	SE

(a) Slemmons, 1979
(b) Mark, 1977
(c) Blake, 1998
(d) Dolan et al., 1995
(e) CDMG, 1996
(f) Anderson, 1984
(g) Wesnousky, 1986
(h) Hummon et al., 1994
SS Strike Slip
NO Normal Oblique
RO Reverse Oblique

Active Faults

Santa Monica Fault

The closest active fault to the site is the Santa Monica fault located approximately 460 meters to the north (Pratt et al., 1998). The Santa Monica fault is the western segment of the Santa Monica-Hollywood fault zone which trends east-west from the Santa Monica coastline on the west to the Hollywood area on the east. In the Santa Monica area, the Santa Monica fault splays into two segments, the North Branch and the South Branch. Several investigators (Dolan et al., 2000a; Dolan et al., 1997; Hummon et al., 1992; Dolan and Sieh, 1992; and Crook and Proctor, 1992) have indicated that the fault is active, based on geomorphic evidence and fault trenching studies. Also, several recent studies indicate that the Santa Monica fault does not extend east of the northerly extension of the Newport-Inglewood fault zone or the West Beverly Hills Lineament of Dolan and Sieh (1997, 1992). An Alquist-Priolo Earthquake Fault Zone has not been established for the Santa Monica fault because of the absence of well-defined fault traces. However, the Santa Monica fault is considered active by the State Geologist.

Newport-Inglewood Fault Zone

The active Inglewood fault of the Newport-Inglewood fault zone is located approximately 1.8 kilometers east of the site. This fault zone is composed of a series of discontinuous northwest-trending en echelon faults extending from Ballona Gap southeastward to the area offshore of Newport Beach. This zone is reflected at the surface by a line of geomorphically young anticlinal hills and mesas formed by the folding and faulting of a thick sequence of Pleistocene age sediments and Tertiary age sedimentary rocks (Barrows, 1974). Fault-plane solutions for 39 small earthquakes (between 1977 and 1985) show mostly strike-slip faulting with some reverse faulting along the north segment (north of Dominguez Hills) and some normal faulting along the south segment (south of Dominguez Hills to Newport Beach) (Hauksson, 1987). Investigations by Law/Crandall (1993) in the Huntington Beach area indicate that the North Branch segment of the Newport-Inglewood fault zone offsets Holocene age alluvial deposits in the vicinity of the Santa Ana River.

Hollywood Fault

The active Hollywood fault is located approximately 3.2 kilometers north of the site. This fault trends east-west along the base of the Santa Monica Mountains from the West Beverly Hills

Lineament in the West Hollywood-Beverly Hills area (Dolan and Sieh, 1992) to the Los Feliz area of Los Angeles. The fault is a ground-water barrier within Holocene sediments (Converse et al., 1981). Scarps 1.8 to 2.7 meters high in Holocene flood plain deposits have been suggested along the fault trace in the Atwater area (Weber et al. 1980). Studies by several investigators (Dolan et al., 2000b; Dolan et al., 1997; Dolan and Sieh, 1992; and Crook and Proctor, 1992) have indicated that the fault is active, based on geomorphic evidence, stratigraphic correlation between exploratory borings, and fault trenching studies. Additionally, recent investigations performed in the Hollywood area by Law/Crandall (2000) have demonstrated that Holocene age alluvial sediments have been offset by several strands of the Hollywood fault. An Alquist-Priolo Earthquake Fault Zone has not been established for the Hollywood fault. However, the Hollywood fault is considered active by the State Geologist. Also, the City of Los Angeles considers the Hollywood fault active for planning purposes.

San Andreas Fault Zone

The active San Andreas fault zone is located about 61 kilometers northeast of the site. This fault zone, California's most prominent geological feature, trends generally northwest for almost the entire length of the state. The southern segment, closest to the site, is approximately 450 kilometers long and extends from the Mexican Border to the Transverse Ranges west of Tejon Pass. Wallace (1968) estimated the recurrence interval for a magnitude 8.0 earthquake along the entire fault zone to be between 50 and 200 years. Sieh (1984) estimated a recurrence interval of 140 to 200 years. The 1857 Fort Tejon earthquake was the last major earthquake along the San Andreas fault zone in Southern California.

Blind Thrust Fault Zones

Northridge Thrust

The Northridge Thrust, as defined by Petersen et al. (1996), is an inferred deep thrust fault that is considered the eastern extension of the Oak Ridge fault. The Northridge Thrust is located beneath the majority of the San Fernando Valley and is believed to be the causative fault of the January 17, 1994 Northridge earthquake. This thrust fault is not exposed at the surface and does not present a potential surface fault rupture hazard. However, the Northridge Thrust is an active feature that can generate future earthquakes. The vertical surface projection of the Northridge Thrust is approximately 10 kilometers northwest of the site at the closest point. Petersen et al. (1996)

estimates an average slip rate of 1.5 mm/yr. and a maximum magnitude of 6.9 for the Northridge Thrust.

Compton-Los Alamitos Thrust

The Compton-Los Alamitos Thrust, as defined by Dolan et al. (1995), is an inferred blind thrust fault located within the south-central portion of the Los Angeles Basin. The closest edge of the vertical surface projection of the buried thrust fault is located about 12 kilometers southeast of the site. This deep buried thrust fault is suggested to extend over 80 kilometers from the Santa Monica Bay coastline southeast into northwestern Orange County. The Compton-Los Alamitos Thrust may connect with the Elysian Park Thrust (to the northeast) along a detachment fault below Los Angeles. Like other blind thrust faults in the Los Angeles area, the Compton-Los Alamitos Thrust is not exposed at the surface and does not present a potential surface rupture hazard. However, the Compton-Los Alamitos Thrust should be considered an active feature capable of generating future earthquakes. An average slip rate of 1.5 mm/yr and a maximum magnitude of 6.8 are estimated by Petersen et al. (1996) for the Compton-Los Alamitos Thrust.

Elysian Park Thrust

The Elysian Park Thrust, previously defined by Hauksson (1990) as the Elysian Park Fold and Thrust Belt, was postulated to extend northwesterly from the Santa Ana Mountains to the Santa Monica Mountains, extending westerly and paralleling the Santa Monica-Hollywood and Malibu Coast faults. The Elysian Park Thrust is now believed to be smaller in size, only underlying the central Los Angeles Basin (Petersen et al., 1996). The vertical surface projection of the Elysian Park Thrust is about 18_ kilometers east-southeast of the site at its closest point. Like other blind thrust faults in the Los Angeles area, the Elysian Park Thrust is not exposed at the surface and does not present a potential surface rupture hazard; however, the Elysian Park Thrust should be considered an active feature capable of generating future earthquakes. An average slip rate of 1.5 mm/yr and a maximum magnitude of 6.7 are estimated by Petersen et al. (1996) for the Elysian Park Thrust.

Potentially Active Faults

Overland Fault

The dosest potentially active fault to the site is the Overland fault located approximately 1.8 kilometers to the west. The Overland fault trends northwest between the Charnock fault and the Newport-Inglewood fault zone. The fault extends from the northwest flank of the Baldwin Hills to Santa Monica Boulevard in the vicinity of Overland Avenue. Based on water level measurements, displacement along the fault is believed to be vertical, with an offset of about 9 meters (Poland, 1959). The west side of the fault has apparently moved downward, relative to the east side, forming a graben between the Charnock and Overland faults. However, there is no evidence that this fault has offset late Pleistocene or Holocene age alluvial deposits (County of Los Angeles Seismic Safety Element, 1990). Ziony and Jones (1989) indicate that the fault is potentially active (no displacement of Holocene age alluvium). Additionally, the State Geologist considers this fault to be potentially active (Jennings, 1994).

Charnock Fault

The potentially active Charnock fault is located approximately 5.4 kilometers south-southwest of the site. The Charnock fault trends northwest-southeast, subparallel to the trend of the Newport-Inglewood fault zone and the Overland fault. Differential water levels across the fault occur in the early Pleistocene age San Pedro Formation. However, there is no evidence that this fault has offset late Pleistocene or Holocene age alluvial deposits (County of Los Angeles Seismic Safety Element, 1990). Ziony and Jones (1989) indicate that the fault is potentially active (no displacement of Holocene age alluvium). Additionally, the State Geologist considers this fault to be potentially active (Jennings, 1994).

MacArthur Park Fault

The potentially active MacArthur Park fault is located about 10_ kilometers east-northeast of the site. The fault, inferred west of downtown Los Angeles, has been located based on south-facing scarps, truncated drainages, and other geomorphic features (Dolan and Sieh, 1993). The fault is approximately 8 kilometers long, extending northwest from the Pershing Square area in downtown Los Angeles through MacArthur Park to the Paramount Studios area in Hollywood. Current information suggests the fault is potentially active.

4.5 MINERAL RESOURCES

The alluvial deposits underlying the site are not suitable as a potential source of aggregate. Additionally, our review of published aggregate resources indicates the site is not within an area of historic aggregate production; therefore, the proposed development would not result in the loss of potential aggregate at the site (Evans et al., 1979).

The site is located within the boundaries of a designated oil field. If it is economically desirable to exact petroleum or natural gas resources beneath the site in the future, these resources could be extracted from off-site wells. Therefore, the potential for loss of existing oil or natural gas resources as a result of the proposed project is considered to be low.

4.6 LANDFORM ALTERATION

There are no unique geologic or physical features at the site or in the immediate vicinity. Therefore, no unique geologic or physical features will be modified, permanently covered, or destroyed as a result of the proposed development.

4.7 GEOLOGIC-SEISMIC HAZARDS

Fault Rupture

The site is not within a currently established Alquist-Priolo Earthquake Fault Zone for surface fault rupture hazards. The closest Alquist-Priolo Earthquake Fault Zone, established for a portion of the Inglewood fault of the Newport-Inglewood fault zone, is located approximately 4.4 kilometers to the southeast of the site. Based on the available geologic data, active or potentially active faults with the potential for surface fault rupture are not known to be located directly beneath or projecting toward the site. Therefore, the potential for surface rupture due to fault plane displacement propagating to the surface at the site during the design life of the project is considered low.

Seismicity

Earthquake Catalog Data

The seismicity of the region surrounding the site was determined from research of an electronic database of seismic data (Southern California Seismographic Network, 2001). This database includes earthquake data compiled by the California Institute of Technology for 1932 to 2000 and data for 1812 to 1931 compiled by Richter and the U.S. National Oceanic Atmospheric Administration (NOAA). The search for earthquakes that occurred within 100 kilometers of the site indicates that 400 earthquakes of Richter magnitude 4.0 and greater occurred between 1932 and 2000; no earthquakes of magnitude 6.0 or greater occurred between 1906 and 1931; and one earthquake of magnitude 7.0 or greater occurred between 1812 and 1905. A list of these earthquakes is presented as Table 3, List of Historic Earthquakes, at the end of this report. Epicenters of moderate and major earthquakes (greater than magnitude 6.0) are shown in Figure 3.

The information for each earthquake includes date and time in Greenwich Civil Time (GCT), location of the epicenter in latitude and longitude, quality of epicentral determination (Q), depth in kilometers, distance from the site in kilometers, and magnitude. Where a depth of 0.0 is given, the solution was based on an assumed 16-kilometer focal depth. The explanation of the letter code for the quality factor of the data is presented on the first page of the table.

Historic Earthquakes

A number of earthquakes of moderate to major magnitude have occurred in the Southern California area within the last 68 years. A partial list of these earthquakes is included in the following table.

List of Historic Earthquakes

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Kilometers)	Direction to Epicenter
Long Beach	March 10, 1933	6.4	64	SE
Kern County	July 21, 1952	7.5	127	NW
San Fernando	February 9, 1971	6.6	39	N
Whittier Narrows	October 1, 1987	5.9	31	E
Sierra Madre	June 28, 1991	5.8	45	NE
Landers	June 28, 1992	7.3	175	E
Big Bear	June 28, 1992	6.4	143	E
Northridge	January 17, 1994	6.7	21	NW

Hector Mine	October 16, 1999	7.1	206	ENE

The site could be subjected to strong ground shaking in the event of an earthquake. However, this hazard is common in Southern California and the effects of ground shaking can be mitigated by proper engineering design and construction in conformance with current building codes and engineering practices.

Slope Stability

The site is currently developed and the site topography is relatively level. The exception is a 3:1 to 4:1 (horizontal to vertical gradient) landscaped slope along the southern portion of the site. Also, engineer-designed basement walls are present beneath the existing structures. These walls are approximately 19.8 meters (65 feet) high and are part of the subterranean parking structure at the site. There is also a 4.6-to 6.1-meter-high (15- to 20-foot-high) retaining wall along Olympic Boulevard, at the southern site boundary.

The site is included in the City of Los Angeles "Hillside Area" and the County of Los Angeles Landslide Inventory Study Area because of its location on a topographic rise. However, there are no natural slopes or steep graded slopes at or adjacent to the site. The gentle gradient of the landscaped slope along the southern portion of the site, and the engineered retaining wall and basement walls are considered to be grossly stable. This condition precludes both slope stability problems and the potential for lurching (earth movement at right angles to a cliff or steep slope during ground shaking). There are no known landslides near the site, nor is the site in the path of any known or potential landslides. Additionally, the site is not located within an area identified as having a potential for seismic slope instability (California Division of Mines and Geology, 1999).

Liquefaction

Liquefaction potential is greatest where the ground water level is shallow, and submerged loose, fine sands occur within a depth of about 15 meters (50 feet) or less. Liquefaction potential decreases as grain size and clay and gravel content increase. As ground acceleration and shaking duration increase during an earthquake, liquefaction potential increases.

According to the California Division of Mines and Geology (1999), the City of Los Angeles Safety Element (1996), and the County of Los Angeles Seismic Safety Element (1990), the site is not within an area identified as having a potential for liquefaction. Ground water was not encountered in our previous borings within 15 meters of the ground surface. Additionally, the Pleistocene age sediments underlying the site are generally dense silty sand and firm silty clay and clay silts and are not considered prone to liquefaction. Therefore, the potential for liquefaction and the associated ground deformation beneath the site is considered to be low.

Tsunamis, Inundation, Seiches, and Flooding

The site is not in a coastal area. Therefore, tsunamis (seismic sea waves) are not considered a significant hazard at the site.

The site is not located downslope of any large bodies of water that could adversely affect the site in the event of an earthquake-induced dam failure or seiches (wave oscillations in an enclosed or semi-enclosed body of water).

The site is in an area of minimal flooding potential (Zone C) as defined by the Federal Insurance Administration.

Subsidence

The site is within the Beverly Hills Oil Field. The historic withdrawal of fluids (such as petroleum and ground water) has been known to cause ground subsidence. Documented subsidence associated with petroleum and ground water extraction (and ongoing tectonic processes in the Los Angeles Basin) has occurred within the boundaries of Beverly Hills Oil Field. Between 1955 and 1970, documented subsidence beneath the site was approximately 0.06 meter (0.2 feet) (Hill et. al., 1979). However, this subsidence is regional in nature and there is no evidence that differential settlement or damage to structures has occurred as a result of this phenomenon at the site or in the general area. Therefore, regional subsidence is not anticipated to adversely affect the structures at the site.

Volcanic Hazards

The site is not subject to any known volcanic hazards. The two nearest Quaternary age volcanic fields are located about 200 kilometers to the northeast at Amboy and Pisgah Craters and about 210 kilometers to the north near Little lake and the Coso Mountains.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

It is our opinion that the site is suitable for the planned development from a geologic-seismic perspective. The following section summarizes the potential adverse geologic-seismic impacts at the site. The recommended mitigation measures in Section 5.3 would reduce geologic-seismic impacts to a level considered less than significant.

5.2 GEOLOGIC-SEISMIC IMPACTS

The potential loss of mineral resources at the site as a result of the proposed development is not a significant impact. There are no unique geologic features at the site or in the vicinity of the site. Therefore, no unique geologic features will be disturbed as part of the proposed development. Additionally, significant impacts will not result from geologic hazards such as surface fault rupture, liquefaction, tsunamis, inundation, seiches, flooding, subsidence, and volcanic hazards.

In the absence of compliance with current building code requirements and the recommendations for engineering design provided in the comprehensive geotechnical report for the proposed development, the geologic-seismic impacts that could significantly affect the proposed development are limited to strong ground shaking

5.3 DESIGN/MITIGATION MEASURES

General

As part of the mitigation measures for the development as a whole, the proposed project will be designed and built in compliance with City of Los Angeles building code requirements. The City of Los Angeles will require that the results of the comprehensive geotechnical investigation be submitted as part of the permitting process for the project. The City of Los Angeles will require that the specific design recommendations presented in the comprehensive geotechnical report be incorporated into the design and construction of the proposed project.

Proper engineering design and conformance with recommendations presented in the comprehensive geotechnical report for the project and with current building codes as required by the City of Los Angeles, will reduce the identified potential geologic-seismic impacts to a level that is less than significant.

Ground Shaking

The site could be subjected to strong ground shaking. However, the hazards associated with ground shaking are common in seismically active Southern California. The location of the site relative to known active or potentially active faults indicates the site is not exposed to a greater seismic risk than other sites in the Century City area of Los Angeles. The site is not within an area identified by the California Division of Mines and Geology (1999) as having a potential for seismic slope instability.

The proposed development will be designed and built to provide life safety for occupants of the structures in the event of the strong earthquake ground motions expected to occur in the vicinity of the site, as determined as part of the comprehensive geotechnical investigation for the proposed development. Potential impacts that could significantly affect the proposed development as a result of ground shaking will be reduced to a less than significant level with proper engineering design and conformance with the recommendations presented in the comprehensive geotechnical report for the proposed development and the City of Los Angeles building code requirements.

5.4 IMPACTS AFTER MITIGATION

There are no geologic or seismic impacts that would not be reduced to a less than significant level by compliance with current building codes and the recommendations presented in the comprehensive geotechnical report for the proposed development. In our opinion, the site is suitable for the proposed development from a geologic-seismic perspective.

6.0 BIBLIOGRAPHY

Anderson, J. G., 1984, "Synthesis of Seismicity and Geologic Data in California," U.S. Geological Survey Open File Report 84-424.

Anderson, J. G., and Luco, J. E., 1983, "Consequences of Slip Rate Constraints on Earthquake Occurrence Relations," *Bulletin of the Seismological Society of America*, Vol. 73, No. 2, p. 471-496.

Blake, 1995, revised 1998, "FRISKSP, A Computer Program for Probabilistic Estimation of Peak Acceleration and Uniform Hazard Spectra Using 3-D Faults as Earthquake Sources".

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1994, "Estimation of Response Spectra and Peak Accelerations from Western North American Earthquakes: An Interim Report, Part 2," U.S. Geological Survey Open File Report 94-127.

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1993, "Estimation of Response Spectra and Peak Accelerations from Western North American Earthquakes: An Interim Report," U.S. Geological Survey Open File Report 93-509.

Bryant, W. A., 1988, "Recently Active Traces of the Newport-Inglewood Fault Zone, Los Angeles and Orange Counties, California," Open File Report 88-14.

Bullard, T. R. and Lettis, W. R., 1993, "Quaternary Fold Deformation Associated with Blind Thrust Faulting, Los Angeles Basin, California," *Journal of Geophysical Research*, Vol. 98, No. B5, pp. 8349-8369.

California Department of Water Resources, 1961, "Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County, App. A, Groundwater Geology," Bulletin 104.

California Division of Mines and Geology, 1999, "State of California Seismic Hazard Zones, Beverly Hills Quadrangle, Official Map" released March 25, 1999.

California Division of Mines and Geology, 1998, "Seismic Hazard Evaluation of the Beverly Hills 7.5-Minute Quadrangle,Los Angeles County, California" Open File Report 98-14.

California Division of Mines and Geology, 1997, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," Special Publication 117.

California Division of Mines and Geology, 1996, "Probabilistic Seismic Hazard Assessment for the State of California" Open File Report 96-08.

California Division of Mines and Geology, 1986, "State of California Special Studies Zones, Beverly Hills Quadrangle Map, Revised Official Map, Effective July 1, 1986."

California Division of Oil, Gas, and Geothermal Resources, 1996, "Beverly Hills Oil Field, Map No. 117."

Converse Consultants, Earth Science Associates, Geo-Resource Consultants, 1981, "Geotechnical Investigation Report, Volume I; Volume II–Appendices 1 and 2," for Southern California Rapid Transit Metro Rail Project.

Converse Davis and Associates, 1972, "Groundwater Investigation Vicinity of Forest Lawn, Glendale-Los Angeles, California," CDA Project 70-044-EH, Report April 4, 1972, Drawings 1 and 2.

Cramer, C. H. and Petersen, M. D., 1996, "Predominant Seismic Source Distance and Magnitude Maps for Los Angeles, Orange, and Ventura Counties, California," *Bulletin of Seismological Society of America*, Vol. 86, No. 5, pp. 1645-1649.

Crook, R., Jr., and Proctor, R. J., 1992 "The Santa Monica and Hollywood Faults and the Southern Boundary of the Transverse Ranges Province" in *Engineering Geology Practice in Southern California*.

Dibblee, T. W., Jr., 1991, "Geologic Map of the Beverly Hills and Van Nuys (South _) Quadrangles, Los Angeles County, California".

Dolan, J. F., Sieh, K., and Rockwell, T. K., 2000a, "Late Quaternary Activity and Seismic Potential of the Santa Monica Fault System, Los Angeles, California", Geological Society of America Bulletin, Vol 112, No. 10, October 2000.

Dolan, J. F., Stevens, D., and Rockwell, T. K, 2000b, ""Paleoseismologic Evidence for an Early to Mid-Holocene Age of the Most Recent Surface Fault Rupture on the Hollywood Fault, Los Angeles, California" *Bulletin of the Seismological Society of America*, April 2000.

Dolan, J. F., Sieh, K. E., Rockwell, T. K., Guptill, P., and Miller, G., 1997, "Active Tectonics, Paleoseismology, and Seismic Hazards of the Hollywood Fault, Northern Los Angeles Basin, California," *Geological Society of America Bulletin*, Vol. 109, No. 12.

Dolan, J. F., et al., 1995, "Prospects for Larger or More Frequent Earthquakes in the Los Angeles Metropolitan Region, California," *Science 267*, 199-205 pp.

Dolan, J. F. and Sieh K., 1993, "Tectonic Geomorphology of the Northern Los Angeles Basin: Seismic Hazards and Kinematics of Young Fault Movement."

Dolan, J. F. and Sieh, K., 1992, "Paleoseismology and Geomorphology of the Northern Los Angeles Basin: Evidence for Holocene Activity on the Santa Monica Fault and Identification of New Strike-Slip Faults through Downtown Los Angeles," *EOS, Transactions of the American Geophysical Union*, Vol. 73, p. 589.

Evans, J. R., 1979 "Aggregates in the Greater Los Angeles Area, "California Division of Mines and Geology Special Report 139.

Hart, E. W., 1973, revised 1997, "Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zone Maps," California Division of Mines and Geology Special Publication 42.

Hauksson, E., 1990, Earthquakes, Faulting, and Stress in the Los Angeles Basin," *Journal of Geophysical Research*, Volume 95, No. B10, pp. 15,365-15,394.

Hauksson, E., 1987, "Seismotectonics of the Newport-Inglewood Fault Zone in the Los Angeles Basin, Southern California," *Bulletin of the Seismological Society of America*, Vol. 77, pp. 539-561.

Hill, R. L., Sprotte, E. C., Chapman, R . H., Chase, G. W., Bennett, J. H., Real, C. R., Borchardt, G., and Weber, F. H., Jr., 1979, "Earthquake Hazards Associated with Faults in the Greater Los Angeles Metropolitan Area, Los Angeles County, California, Including Faults in the Santa Monica–Raymond, Verdugo–Eagle Rock and Benedict Canyon Fault Zones," California Division of Mines and Geology, Open File Report 79-16LA.

Hoots, H. W., 1930, "Geology of the Eastern Part of the Santa Monica Mountains, Los Angeles Basin," in Shorter Contributions to General Geology, U.S. Geological Survey Professional Paper 165.

Hummon, C., Schnieder, C. L., Yeats, R. S., Dolan, J. F., Sieh, K. E., and Huftile, G. J., 1994, "Wilshire Fault: Earthquakes in Hollywood?," *Geology*, Vol. 22, pp. 291-294.

Hummon, C., Schneider, C. L., Yeats, R. S., and Huftile, G. J., 1992, "Active Tectonics of the Northern Los Angeles Basin: An Analysis of Subsurface Data", in Proceedings of the 35th Annual Meeting of the Association of Engineering Geologists".

Jackson, D. D., et.al., 1995, "Seismic Hazards in Southern California: Probable Earthquakes, 1994 to 2024, *Bulletin of the Seismological Society of America*, Volume 85, Number 2.

Jennings, C. W., 1994, "Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions," California Division of Mines and Geology Map No. 6.

Kramer, S. L., 1996, "Geotechnical Earthquake Engineering," Prentice Hall.

Law/Crandall, 2001, " Draft Report of Geotechnical Consultation, Proposed High-Rise Office Building and Retail Development, 2000 Avenue of the Stars, Century City District of Los Angeles, California" Prepared for Trammel Crow So. Cal., Inc, Report dated October 5, 2001 (Project No. 70131-1-0242).

Law/Crandall, 2000, "Report of Fault Rupture Hazard Investigation, 1840 North Highland Avenue, Hollywood District, Los Angeles, California, Prepared for Citistate, Inc." Project No. 70131-9-0337.0001.

Law/Crandall, 1993, "Report of Potential Fault Displacements, Wastewater Treatment Plant Number 2, Huntington Beach, California, for County Sanitation Districts of Orange County" Project No. 2661.30140.0001.

LeRoy Crandall and Associates, 1967, "Preliminary Report of Foundation Investigation, Proposed Theater Development, Avenue of the Stars, Between Constellation and Olympic Boulevards, Century, Los Angeles, California, for the Century City Construction Company" (our Project No. A-67065).

Los Angeles, City of, 1996, "Safety Element of the General Plan".

Los Angeles, County of, 1975, Draft revision 1990, "Seismic Safety Element."

Los Angeles, County of, 1990, "Technical Appendix to the Safety Element of the Los Angeles County General Plan," Draft Report by Leighton and Associates with Sedway Cooke Associates.

Mark, R. K., 1977, "Application of Linear Statistical Models of Earthquake Magnitude Versus Fault Length in Estimating Maximum Expectable Earthquakes," *Geology,* Vol. 5, pp. 464-466.

McNeilan, T. W., Rockwell, T. K., and Resnick, G. S., 1996, "Style and Rate of Holocene Slip, Palos Verdes Fault, Southern California", *Journal of Geophysical Research*, April 10, 1996, v. 101, no. B4, p. 8317-8334.

Moran, D. E., Chase, E. D., and Shlemon, R. J., 1986, "Late Pleistocene Channel of the Los Angeles River, Ballona Gap, Los Angeles, California", *Geological Society of America, Abstracts with Programs*, Vol. 18, No. 2.

Petersen, M. D., Bryant, W. A., Cramer, C. H., Cao, T., Reichle, M. S., Frankel, A. D., Lienkaemper, J. J., McCrory, P. A., and Schwatz, D. P., 1996, "Probabilistic Seismic Hazard Assessment for the State of California," California Division of Mines and Geology Open File Report 96-08.

Petersen, M. D. and Wesnousky, S. G., 1994, "Fault Slip Rate and Earthquake Histories for Active Faults in Southern California," *Bulletin of the Seismological Society of America*, Vol. 84, pp. 1608-1649.

Poland, J. R., Garrett, A. A., and Sinnott, A., 1959, "Geology, Hydrology, and Chemical Character of Ground Waters in the Torrance–Santa Monica Area, California," U.S. Geological Survey Water Supply Paper 1461.

Pratt, T. L., Dolan, J. F., Odum, J. K., Stephenson, W. J., Williams, R. A., and Templeton, M. E., 1998, "Multiscale Seismic Imaging of Active Fault Zones for Hazard Management: A Case Study of the Santa Monica Fault Zone, Los Angeles", *Geophysics*, Vol. 63, No. 2.

Schneider, C. L., Hummon, C., Yeats, R. S., and Huftile, G. L., 1996, "Structural Evolution of the Northern Los Angeles Basin, California, Based on Growth Strata," *Tectonics,* Vol. 15, No. 2, pp. 341-355.

Shaw, J. H. and Suppe, J., 1996, "Earthquake Hazards of Active Blind Thrust Faults Under the Central Los Angeles Basin, California," *Journal of Geophysical Research*, Vol. 101, No. B4, pp. 8623-8642.

Shaw, J. H., 1993, "Active Blind-Thrust Faulting and Strike-Slip Folding in California," Ph.D. Thesis, Princeton University, Princeton, New Jersey.

Sieh, K. E., 1984, "Lateral Offsets and Revised Dates of Large Pre-historic Earthquakes at Pallett Creek, California," *Journal of Geophysical Research*, Vol. 9, pp. 7461-7670.

Slemmons, D. B., 1979, "Evaluation of Geomorphic Features of Active Faults For Engineering Design and Siting Studies," Association of Engineering Geologists Short Course.

Southern California Seismographic Network, 2001, "Southern California Earthquake Catalog," http://www.scecdc.scec.org/ftp/catalogs/SCSN/.

Toppozada, T. R, Bennett, J. H., Borchardt, G. A., Saul, R., and Davis, J. F., "1988, "Planning Scenario for a Major Earthquake on the Newport–Inglewood Fault Zone," California Division of Mines and Geology Special Publication 99.

U.S. Geological Survey, 1966, "Beverly Hills 7.5-Minute Quadrangle Map," photorevised 1981.

Wallace, R. E., 1968, "Notes of Stream Channel Offset by San Andreas Fault, Southern Coast Ranges, California," in Dickinson, U. R., and Grantz, A., eds., Proceedings of Conference of Geologic Problems on San Andreas Fault System, Stanford University Publications, *Geological Sciences*, Vol. IX, p. 6-21.

Weber, F. H., Bennett, J. H., Chapman, R. H., Chase, G. W., and Saul, R. B., 1980, "Earthquake Hazards Associated with the Verdugo–Eagle Rock and Benedict Canyon Fault Zones, Los Angeles County, California," California Division of Mines and Geology Open File Report 80-10LA.

Wells, D. L., and Coppersmith, K. J., 1994, "New Empirical Relationships Among Magnitude, Rupture Length, Rupture Width, Rupture Area, and Surface Displacement," *Bulletin of the Seismological Society of America*, Volume 84, No. 4, pp. 974-1002.

Wesnousky, S. G., 1986, "Earthquakes, Quaternary Faults and Seismic Hazard in California," *Journal of Geophysical Research*, Vol. 91, No. B12, pp. 12,587-12,631.

Wissler, S. G., 1943, "Stratigraphic Formations of the Producing Zone of the Los Angeles Basin Oil Fields," California Division of Mines and Geology, Bulletin 118, pt. 2, p. 210-234.

Working Group on California Earthquake Probabilities, 1995, "Seismic Hazards in Southern California: Probable Earthquakes, 1994 to 2024," *Bulletin of the Seismological Society of America*, Volume 85, No. 2, April 1995.

Wright, T. L., 1991, "Structural Geology and Tectonic Evolution of the Los Angeles Basin, California," American Association of Petroleum Geologists, Memoir 52, p. 35-134.

Yerkes, R. F., McCulloch, T. H., Schoellhamer, J. E., and Vedder, J. G., 1965, "Geology of the Los Angeles Basin–An Introduction," U.S. Geological Survey Professional Paper 420-A.

Ziony, J. I., ed., 1985, "Evaluating Earthquake Hazards in the Los Angeles Region–An Earth Science Perspective," U.S. Geological Survey Professional Paper 1360.

Ziony, J. I., and Jones, L. M., 1989, "Map Showing Late Quaternary Faults and 1978–1984 Seismicity of the Los Angeles Region, California," U.S. Geological Survey Miscellaneous Field Studies Map MF-1964.