Appendix F2
Seismic Design Parameters (Leighton and Associates 2009)

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2007 CALIFORNIA BUILDING CODE SEISMIC DESIGN PARAMETERS PROPOSED MARTIN RANCH DEVELOPMENT, DEVORE AREA OF UNINCORPORATED SAN BERNARDINO COUNTY (CITY OF SAN BERNARDINO SPHERE OF INFLUENCE), CALIFORNIA

Prepared for:

THE PLANNING CENTER
1580 Metro Drive
Costa Mesa, California 92626

Project No. 022249-002

June 17, 2009

June 17, 2009

Project N. 022249-002

To: The Planning Center
1580 Metro Drive
Costa Mesa, California 92626

Attention: Mr. Michael Milroy

Subject: 2007 California Building Code Seismic Design Parameters, Proposed Martin Ranch Development, Devore Area of Unincorporated San Bernardino County (City of San Bernardino Sphere of Influence), California

Introduction

In response to your request, Leighton and Associates, Inc. (Leighton) is providing these 2007 California Building Code (CBC) Seismic design parameters for the Spring Trails Ranch site. Geotechnical and geologic studies were previously conducted by Kleinfelder, Inc. in the late 1990's and early 2000. A listing of the reports and City of San Bernardino comments by Mr. Floyd Williams is provided in the attached references. We have also reviewed the Geology and Soils (Section 4.1) of a previous Draft Environmental Impact Report (DEIR) for the project. We understand that updated Seismic Design information is required during update of the DEIR.

Faulting and Seismicity

The project site is located in a seismically active southern California region, within two designated Alquist-Priolo Earthquake Fault Zones for the San Andreas Fault. The project site in this zone is likely to be subjected to moderate to strong seismic shaking during the design life of proposed residential structures.

Kleinfelder, Inc. conducted geologic studies of the San Andreas Fault onsite, identified several active splays of the fault, and recommended structural setbacks away from some of those splays. They excavated twenty-six exploratory trenches totaling approximately 6,000 lineal feet to identify and assess possible faulting within the proposed development area (Kleinfelder, 1997, 1998, 1999). However, Kleinfelder's 1998 report was not available for review during this study.

The known regional active and potentially active faults that could produce the most significant ground shaking at the site include the San Andreas, the northwest-trending San Jacinto Fault (located approximately three miles to the southwest), the Cucamonga Fault (located approximately five miles to the southwest) and the North Frontal Fault system located near the northern foothills of the San Bernardino Mountains, approximately 7 miles north of the site. The San Jacinto Fault system branches off the San Andreas Fault approximately 10 miles northwest of the site and displays a right-lateral sense of movement. Near the project site it has two segments, the Lytle Creek Fault and the Glen Helen Fault. The Cucamonga Fault interacts with the Sierra Madre Fault at its western end. Together these comprise a thrust fault zone where the San Gabriel Mountains are being pushed up and over the Los Angeles basin. A summary of these faults is provided below. A listing of all known active and potentially active faults within 100 kilometers of the site is provided in Appendix B.

Significant Faults Near the Project Site

Fault Name	Approximate Distance From Site km (mi.)	Maximum Event (Moment Mag.)
San Andreas - San Bernardino Branch	On Site	7.5
San Andreas - Mojave Branch	12 (8)	7.4
San Jacinto - San Bernardino Branch	5 (3)	6.7
Cucamonga	7 (4)	6.9
North Frontal - Western Branch	13 (8)	7.2

An evaluation of historical seismicity related to the site was performed to show significant past earthquakes since 1800 with magnitudes 4 or greater within 100 miles of the site. These earthquakes were evaluated using the EQSEARCH computer program (Blake, 2000b). A summary of past earthquakes is provided below. More detailed information on historical seismicity is provided in Appendix B.

Earthquake History Between 1800 and 2009

Time Period (1800 to 2009)	Over 210Years
Maximum Magnitude	M 7.6
Approximate distance to nearest historical earthquake	2 miles
Number of events exceeding magnitude 4.0 within search area (100 miles)	167

Source: California Division of Mines and Geology

Site-Specific Probabilistic Seismic Hazard Analysis

A probabilistic seismic hazard analysis was performed using the computer program EZ-FRISK (Risk Engineering, 2009) to estimate peak horizontal ground acceleration (PHGA) that could occur at the site. Various probabilistic density functions were used in the analysis to assess the uncertainty inherent in the calculation with respect to magnitude, distance and ground motion. An averaging of four attenuation relationships with equal weights (Abrahamson-Silva, 2008; Boore-Atkinson, 2007; Campbell-Bozorgnia, 2008; and Chiou-Youngs, 2008) were used to calculate the PHGA at the site. These probabilistic design level events are defined in the Table below:

Design Level	Return Period (years)	Definition	Peak Horizontal Ground Acceleration (g)
MCE	2475	2% probability of exceedance in 50 years	1.15

PHGA for the site was also estimated using the California Geologic Survey's (CGS's) Probabilistic Seismic Hazards Mapping Ground Motion data (CGS, 2008), which utilizes a probabilistic seismic hazard analysis approach based on currently available earthquake and fault information. Based on information from the CGS, the PHGA with a 10 percent probability of being exceeded in 50 years is estimated to be approximately 0.88g.

Probabilistic seismic hazard analysis acceleration values and probabilities should only be considered reasonable best estimates. All of the influences affecting attenuation and occurrence rates are not yet known. Furthermore, there are uncertainties in every parameter used to obtain such results. At the present time, there is no test available to verify the validity of the acceleration and probability data. Therefore, significant deviations from the indicated values are possible due to geotechnical and geological uncertainties and other site-specific conditions.

2007 California Building Code Seismic Design Parameters

Site-specific seismic parameters presented below are based on the 2007 edition of the California Building Code (CBC). The following data should be used for the seismic analysis of the subject site.

2007 CBC Seismic Design Parameters	Value
Site Longitude (decimal degrees)	-117.3719
Site Latitude (decimal degrees)	34.2196
Site Class Definition (Table 1613.5.2)	C
Mapped Spectral Response Acceleration at 0.2s Period, S_s (Figure 1613.5(3))	2.175
Mapped Spectral Response Acceleration at 1s Period, S_1 (Figure 1613.5(4))	1.066
Short Period Site Coefficient at 0.2s Period, F_a (Table 1613.5.3(1))	1.0
Long Period Site Coefficient at 1s Period, F_v (Table 1613.5.3(2)	1.3
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS} (Eq. 16-37)	2.175
Adjusted Spectral Response Acceleration at 1s Period, S_{M1} (Eq. 16-38)	1.386
Design Spectral Response Acceleration at 0.2s Period, S_{DS} (Eq. 16-39)	1.450
Design Spectral Response Acceleration at 1s Period, S_{D1} (Eq. 16-40)	0.924

We hope this provides the information needed at this time. Please contact us if you have any questions regarding this letter.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

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PB/JDH/rsh
Attachments: Appendix A - References
Appendix B - Historic Seismicity and Fault Database
Distribution: (4) Addressee

APPENDIX A

APPENDIX A

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Williams, Floyd J., 2007, Martin Ranch Project, Tentative Tract 15576, your letter of October 15, 2007, dated November 3, 2007.

<u>Reports referenced in previous documents but not reviewed by Leighton</u>:

Kleinfelder, 1998, Response to Geologic Review Comments, Proposed Martin Ranch Subdivision, Tentative Tract Map No. 15576, and CUP 96-20, San Bernardino County, California, Project No. 58-425001, dated October 13, 1998.

APPENDIX B

T R A N S M I T T A L

To: The Planning Center
1580 Metro Drive
Costa Mesa, California 92626

Date: June 17, 2009

Project No. 022249-002

Attention: Mr. Michael Milroy

Transmitted:		The Following:		For:	
X	Golden State Overnight	____	Draft Report	X	Your Use
____	Courier	X	Final Report	____	As Requested
____	Pick Up	____	Extra Report		
		____	Proposal		
		____	Other		

Subject: 2007 California Building Code Seismic Design Parameters Proposed Martin Ranch Development, Devore Area of Unincorporated San Bernardino County (City of San Bernardino Sphere of Influence), California

LEIGHTON AND ASSOCIATES, INC.

By: Philip A. Buchiarelli

Distribution: (4) Addressee