Zipper Zeman Associates, Inc.
Geotechnical and Environmental Consulting
A Terracon Company

ZZA Project No. 81075643
September 25, 2007

City of Renton
1055 South Grady Way
Renton, WA 98055

Attn: Mr. Peter Renner, Facilities Director

Subject: Geotechnical Earthquake Engineering Study
Old Renton City Hall
200 Mill Avenue South
Renton, Washington

Dear Mr. Renner,

This letter report presents the results of our geotechnical earthquake engineering study in support of the seismic evaluation for Old Renton City Hall located at 200 Mill Avenue South in Renton, Washington. The purpose of our work was to assess potential seismic hazards presented by local geologic site conditions, and to assist Coffman Engineers in their evaluation of the structure. This Tier 2 evaluation meets the requirements of ASCE/SEI Standard 31-03, *Seismic Evaluation of Existing* Buildings.

SUBSURFACE CONDITIONS

We determined the subsurface soil conditions at the building site from the Report of Foundation Investigation, Proposed City Hall, Renton, Washington, dated December 27, 1966, provided by the City of Renton. The report recommended that the foundation for the building be constructed at elevation 27 feet in very dense, sandy gravel using an allowable bearing pressure of 10,000 pounds per square foot. The structural engineering plans for the building indicated that the building was constructed per the recommendations of the foundation report.

SPECTRAL ACCELERATION

We computed spectral acceleration at the building site in accordance with Section 3.5.2.3.1 of ASCE/SEI 31-03. The very dense, sandy gravel underlying the foundation would be classified as Site Class C. That is, very dense soil with an average Standard Penetration Test blow count greater than 50 ($N_{AVG} > 50$) in the upper 100 feet. Using the site class and the mapped spectral acceleration values S_S and S_1 of 1.351 and 0.469 for longitude 122.203W and latitude 47.481N,

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we computed S_{DS} and S_{D1} to be 0.901 and 0.416. The data sheet from the U.S. Geological Survey website http://earthquake.usgs.gov/research/hazmaps/design/ is enclosed.

GEOLOGIC SITE HAZARDS

We evaluated geologic hazards for the building site in general accordance with Section 4.7.1 of ASCE/SEI 31-03. The Geologic Site Hazards and Foundations Checklist, with our conclusions regarding the geologic site hazards, is enclosed with this letter.

Liquefaction

Soil liquefaction occurs in saturated, loose to medium dense sands, and to a lesser extent silts and gravels. Recently (Holocene epoch) deposited sands in deltaic environments have historically experienced the greatest amount of liquefaction during strong ground shaking. Liquefaction can cause a loss of soil strength and result in lateral or vertical ground movements.

The Old Renton City Hall building is founded in very dense, sandy gravel with a low likelihood of earthquake-induced soil liquefaction.

Slope Failure

Earthquake-induced slope movements may be characterized as either inertial or weakening. Inertial landslides occur when the ground shaking adds a temporary horizontal force to the soil mass that, when combined with the existing gravitational force, exceeds the frictional resistance of the soil. Weakening failures occur when the soil mass losses strength (e.g., liquefaction) and can no longer provide the necessary frictional resistance to remain stable. Earthquake-induced landslides tend to decrease in number with increasing distance from the location of rupture and are generally a function of steepness of the slope.

The Old Renton City Hall building is founded in high strength sandy gravel and the likelihood of earthquake-induced inertial or weakening slope movements is low.

Surface Fault Rupture

Faults are recognized zones of differential earth movement. Stresses build in the Earth's surface over time and release stored energy along these existing zones of weak rock. The history of movement along a given fault can be investigated with geologic studies. Structures located in the path of fault rupture typically experience considerable damage.

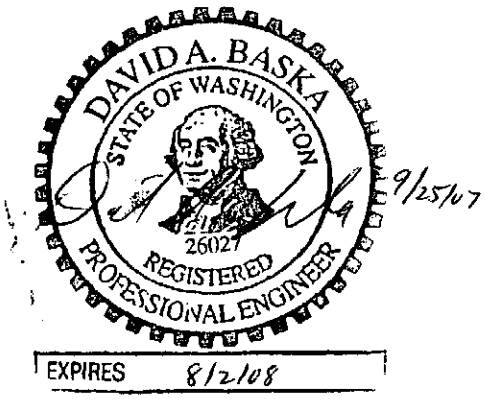
The Seattle Fault Zone represents the earthquake source with the greatest potential for surface fault rupture at the site. The zone comprises at least 3 or 4 splays that extend across the Puget Lowland in generally an east-west orientation. The southernmost fault is inferred to be located approximately 5 km north of the Old Renton City Hall building site. Therefore, the likelihood of surface fault rupture at the site is low.

GENERAL COMMENTS

The findings and conclusions presented in this report are based, in part, upon data obtained by others. This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made.

We appreciate this opportunity to provide the above information. Please call if you have any questions regarding this report.

Sincerely,
Zipper Zeman Associates, Inc.



David A. Baska, Ph.D., P.E., C.E.G.
Engineering Seismologist
Geotechnical Earthquake Engineer

Enclosures: USGS website data sheet
ASCE 31-03 Geologic Site Hazards and Foundations Checklist

cc: Coffman Engineers

Conterminous 48 States
2002 ASCE 7 Standard
Latitude = 47.481
Longitude = -122.203
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0 ,Fv = 1.0
Data are based on a 0.1 deg grid spacing

Period (sec)	Sa (g)	
0.2	1.351	Ss, Site Class B
1.0	0.469	S1, Site Class B

Conterminous 48 States
2002 ASCE 7 Standard
Latitude = 47.481
Longitude = -122.203
Spectral Response Accelerations SMs and SM1
SMs = FaSs and SM1 = FvS1
Site Class C - Fa = 1.0 ,Fv = 1.331

Period (sec)	Sa (g)	
0.2	1.351	SMs, Site Class C
1.0	0.624	SM1, Site Class C

Conterminous 48 States
2002 ASCE 7 Standard
Latitude = 47.481
Longitude = -122.203
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class C - Fa = 1.0 ,Fv = 1.331

Period (sec)	Sa (g)	
0.2	0.901	SDs, Site Class C
1.0	0.416	SD1, Site Class C

Project Old Renton City Hall

Date 9/25/07

COFFMAN ENGINEERS

ZZA / Terracon

3.8 Geologic Site Hazards and Foundations Checklist

This Geologic Site Hazards and Foundations Checklist shall be completed where required by Table 3-2.

Each of the evaluation statements on this checklist shall be marked Compliant (C), Non-compliant (NC), or Not Applicable (N/A) for a Tier 1 Evaluation. Compliant statements identify issues that are acceptable according to the criteria of this standard, while non-compliant statements identify issues that require further investigation. Certain statements may not apply to the buildings being evaluated. For non-compliant evaluation statements, the design professional may choose to conduct further investigation using the corresponding Tier 2 Evaluation procedure; corresponding section numbers are in parentheses following each evaluation statement.

Geologic Site Hazards

The following statements shall be completed for buildings in levels of high or moderate seismicity.

C NC N/A LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.1.1)

C NC N/A SLOPE FAILURE: The building site shall be sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or shall be capable of accommodating any predicted movements without failure. (Tier 2: Sec. 4.7.1.2)

C NC N/A SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site is not anticipated. (Tier 2: Sec. 4.7.1.3)

Condition of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A FOUNDATION PERFORMANCE: There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.1)

The following statement shall be completed for buildings in levels of high or moderate seismicity being evaluated to the Immediate Occupancy Performance Level.

C NC N/A DETERIORATION: There shall not be evidence that foundation elements have deteriorated due to corrosion, sulfate attack, material breakdown, or other reasons in a manner that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.2)

Capacity of Foundations

The following statement shall be completed for all Tier 1 building evaluations.

C NC N/A POLE FOUNDATIONS: Pole foundations shall have a minimum embedment depth of 4 feet for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.3.1)

The following statements shall be completed for buildings in levels of moderate seismicity being evaluated to the Immediate Occupancy Performance Level and for buildings in levels of high seismicity.

C NC N/A OVERTURNING: The ratio of the horizontal dimension of the lateral-force-resisting system at the foundation level to the building height (base/height) shall be greater than $0.6S_a$. (Tier 2: Sec. 4.7.3.2)

Screening Phase (Tier 1)

C	NC	N/A	TIES BETWEEN FOUNDATION ELEMENTS: The foundation shall have ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Class A, B, or C. (Section 3.5.2.3.1, Tier 2: Sec. 4.7.3.3)
C	NC	N/A	DEEP FOUNDATIONS: Piles and piers shall be capable of transferring the lateral forces between the structure and the soil. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.4)
C	NC	N/A	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another shall not exceed one story in height. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.5)