Basis of Design - Performance-Based Design

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KPFF Consulting Engineers
111 SW Fifth Avenue, Suite 2500
Portland, OR 97204
(503) 227-3251 | www.kpff.com
INTRODUCTION AND BACKGROUND

This document outlines the basis of design for the performance-based design and nonlinear response history analysis of the Framework Project in Portland, OR. It is intended to be a living document that will be modified and revised as the project develops and in response to peer review comments.

Performance-based design is pursued for this project because the proposed lateral force-resisting system, consisting of post-tensioned rocking cross-laminated timber (CLT) walls is not included in ASCE/SEI 7-10 Table 12.2-1. Lateral force-resisting systems included in ASCE/SEI 7-10 Table 12.2-1 may be designed for earthquake effects using the prescriptive provisions in ASCE/SEI 7-10. Lateral force-resisting systems not included are still permitted but must be demonstrated to have performance not less than that expected for included systems. This option is available via the performance-based procedures of ASCE/SEI 7-10 Section 1.3.1.3. Note that lateral force-resisting systems for wind effects are not restricted in ASCE/SEI 7-10. Therefore, design for wind effects will still be approached within the performance-based design framework but in a more state-of-the-practice manner.

“Reliability not less than expected” for systems included in ASCE/SEI 7-10 Table 12.2-1 is demonstrated through the following:

- *Design for strength level wind loads* – This evaluation is equivalent to that required for any building, regardless of whether performance-based design is pursued.
- *Emulation of rocking precast concrete walls* – Rocking precast concrete walls are considered equivalent to a special reinforced concrete shear wall (a conforming system in ASCE/SEI 7-10) via ACI 318-11 Section 21.10.3. The prescriptive provisions for earthquake effects of ASCE/SEI 7-10 using the force reduction factor, R, for special reinforced concrete shear walls will therefore serve as a lower-bound on the design.
- *Low probability of collapse* – Nonlinear response history analysis at the Risk Targeted Maximum Considered Earthquake (MCE\(_*R_*) will be conducted to demonstrate a low probability of collapse when subjected to extremely rare earthquake ground motions consistent with the performance objective described in ASCE/SEI 7-10 Chapter C1 (although no explicit calculation of probability of collapse will be pursued).

While the above requirements are sufficient to demonstrate code conformance, the project goals for Framework include an emphasis on sustainability and resilience. These goals are adopted in the structural system through the additional, voluntary criteria which intend to enhance occupant comfort under wind effects and improve structural repairability and performance (low damage design concept) under earthquake effects. These additional, voluntary criteria include:

- *Occupant comfort under a service-level wind event* – This evaluation limits wind drift and acceleration under a service-level wind event.
• Essentially elastic performance under a serviceability earthquake
• Repairable performance under a moderate earthquake – This evaluation provides additional criteria on structural element damage and residual drifts for an earthquake hazard having a 475 year return period.

Note that these additional, voluntary criteria are not necessary to demonstrate “reliability not less than expected” for systems included in ASCE/SEI 7-10 Table 12.2-1. Therefore, while these criteria are included in this document for reference, peer review comments solely related to the additional, voluntary criteria are not intended to be formalized/issued to the Authority Having Jurisdiction (State of Oregon).
**PRIMARY POINTS OF CONTACT**

In discussing issues related to the structural peer review for this project, the following persons shall be considered the primary points of contact:

| Structural Engineer of Record’s Representatives | Eric McDonnell  
KPFF Consulting Engineers | eric.mcdonnell@kpff.com |
|-------------------------------------------------|--------------------------------------------------|
| Geotechnical Engineer of Record’s Representatives | Brett Shipton  
GeoDesign Incorporated | bshipton@geodesigninc.com |
|-------------------------------------------------| Nick Paveglio  
GeoDesign Incorporated | npaveglio@geodesigninc.com |
| Structural Peer Reviewer’s Representatives | Stuart Oliver  
Holmes Consulting Group | stuarto@holmesgroup.com |
|-------------------------------------------------| Didier Pettinga  
Holmes Consulting Group | didierp@holmesgroup.com |
| Academic Peer Reviewer’s Representative | Jeff Berman  
University of Washington | jwberman@myuw.net |
| Ground Motions Peer Reviewer’s Representative | Ivan Wong  
AECOM | wong@lettisci.com |
SITE DESCRIPTION

Framework will be located on a quarter block in Portland’s Pearl District at 430 NE 10th Avenue, Portland, OR. There is an existing 2-story office building that currently sits on the site that will be demolished for the construction of the new building. The site is approximately 10,000 square feet and is bordered on the south by an existing 2-story building and to the east by a project that will be under construction for a new 10-story hotel with one level below grade.

BUILDING DESCRIPTION

Framework is a proposed 130ft mass timber building in Portland, OR consisting of 12-stories above grade with one floor of retail, five levels of office, five levels of residential and a penthouse. Its floor plate is approximately 90ft in the east-west direction and north-south directions and is fairly consistent for the entire structural height.

Framework’s gravity system will consist of 2" gypsum concrete topping over cross-laminated (CLT) floor panels spanning to glue-laminated timber (GLT) beams and GLT columns. CLT panels and GLT beams will act compositely via the use of long, self-tapping screws.

Framework’s lateral force-resisting system for both wind and earthquake demands will be post-tensioned rocking CLT walls. The post-tensioned rocking CLT walls consist of (1) CLT wall panels, (2) GLT columns at each end of the CLT wall panels, (3) external threaded rods running the full building height for post-tensioning, (4) energy dissipation devices at the base of the wall, and (5) energy dissipation devices along the full building height between CLT wall panels and GLT columns. The lateral force-resisting system is intended to emulate the Precast Wall with End Columns (PreWEC) system developed for precast concrete. The CLT floor panels will serve as the diaphragm for distributing loads to the lateral force-resisting system with steel plate collectors running above the CLT floor panels (covered by gypsum concrete).
A reinforced concrete mat (raft) foundation at grade will serve as the foundation system below the rocking walls. A combination of strip footings and spread footings will support the remainder of the gravity system. Ground improvements will be located under all primary foundation elements.

**CODES AND REFERENCES**

The following codes and references are applicable.

- **2014 Oregon Structural Specialty Code**
- **Building Code Requirements for Structural Concrete ACI 318-11**, American Concrete Institute.
- **Requirements for Design of a Special Unbonded Post-Tensioned Precast Shear Wall Satisfying ACI ITG-5.1 and Commentary**, American Concrete Institute.
- **Seismic Evaluation and Retrofit of Existing Buildings, ASCE/SEI 41-13**, American Society of Civil Engineers, Structural Engineering Institute.
RESPONSE SPECTRA AND GROUND MOTIONS

Site-specific response spectra and ground motions for Framework have been provided by GeoDesign Incorporated. Reference their reports entitled “Performance-Based Seismic Design, Spectral Matching Results” dated June 20th 2016 and “Performance-Based Seismic Design, Ground Motion Evaluation” dated September 7th 2016.

REQUIREMENTS TO DEMONSTRATE CODE EQUIVALENT PERFORMANCE

As discussed in the section entitled “Introduction and Background”, the use of post-tensioned rocking CLT walls requires demonstration that Framework’s lateral force-resisting system has equivalent performance to a conforming system in ASCE/SEI 7-10. The following subsections address the design criteria for these requirements.

Strength-Level Wind Criteria

The strength-level wind event and criteria are taken the same as for any conforming system in ASCE/SEI 7-10 in accordance with Table 1 below. In fact, there is no distinction between a conforming and a non-conforming lateral force-resisting system in ASCE/SEI 7-10 for wind effects. The velocity has been determined based on a site-specific wind study performed by International Climatic Evaluations Incorporated. Reference their report entitled “Site-Specific Wind Data for the Framework Project in Portland, Oregon” dated March 8th 2016. The velocity determined by International Climatic Evaluations Incorporated matches very closely with the velocity to be published in ASCE 7-16 for Portland. It should be noted that ASCE/SEI 7-10 only requires strength design for wind effects. No drift or acceleration limits exist.

Table 1. Strength-level wind criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Category</td>
<td>II</td>
<td>ASCE/SEI 7-10 Table 1.5-1</td>
</tr>
<tr>
<td>V</td>
<td>97mph (700 year mean recurrence interval, 3 second gust, 33ft, Exposure Category C)</td>
<td>Site-Specific Wind Study</td>
</tr>
<tr>
<td>K_d</td>
<td>0.85</td>
<td>ASCE/SEI 7-10 Table 26.6-1</td>
</tr>
<tr>
<td>Exposure Category</td>
<td>B</td>
<td>ASCE/SEI 7-10 Section 26.7</td>
</tr>
<tr>
<td>K_zt</td>
<td>1.0</td>
<td>ASCE/SEI 7-10 Section 26.8</td>
</tr>
<tr>
<td>G</td>
<td>varies</td>
<td>ASCE/SEI 7-10 Section 26.9.5</td>
</tr>
<tr>
<td>GC_p0i</td>
<td>+/- 0.18</td>
<td>ASCE/SEI 7-10 Table 26.11-1</td>
</tr>
</tbody>
</table>
Design-Level Seismic Criteria

As described in the section entitled “Introduction and Background”, the purpose of the design-level seismic criteria is to establish equivalency to the strength requirements enforced for rocking precast concrete walls (which Framework’s lateral force-resisting system is emulating) in ASCE/SEI 7-10. Prescriptive design taking design values for special reinforced concrete walls is therefore pursued as shown in Table 2. Although design values for special reinforced concrete walls are being used, modeling will be based on the actual geometry and materials, not on those for an equivalent concrete wall. Design will also be in accordance with ACI ITG-5.2-09.
Table 2. Design-level seismic criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis Procedure</td>
<td>Modal Response Spectrum</td>
<td>ASCE/SEI 7-10 Section 12.9</td>
</tr>
<tr>
<td>Software</td>
<td>ETABS 2016</td>
<td></td>
</tr>
<tr>
<td>P-Delta Effects</td>
<td>Considered</td>
<td></td>
</tr>
<tr>
<td>Risk Category</td>
<td>II</td>
<td>ASCE/SEI 7-10 Table 1.5-1</td>
</tr>
<tr>
<td>$I_e$</td>
<td>1.0</td>
<td>ASCE/SEI 7-10 Table 1.5-2</td>
</tr>
<tr>
<td>Seismic Design Category</td>
<td>D</td>
<td>ASCE/SEI 7-10 Section 11.6</td>
</tr>
<tr>
<td>$R$</td>
<td>6</td>
<td>ASCE/SEI 7-10 Table 12.2-1</td>
</tr>
<tr>
<td>$\rho$</td>
<td>1.0</td>
<td>ASCE/SEI 7-16 Section 16.1.2</td>
</tr>
<tr>
<td>$T_a$</td>
<td>0.76 sec East-West</td>
<td>ASCE/SEI 7-10 Section 12.8.2.1</td>
</tr>
<tr>
<td></td>
<td>0.76 sec North-South</td>
<td></td>
</tr>
<tr>
<td>$C_u$</td>
<td>1.4</td>
<td>ASCE/SEI 7-10 Table 12.8-1</td>
</tr>
<tr>
<td>$C_s$</td>
<td>0.0488 East-West</td>
<td>ASCE/SEI 7-10 Section 12.8.1.1</td>
</tr>
<tr>
<td></td>
<td>0.0488 North-South</td>
<td></td>
</tr>
<tr>
<td>Accidental Torsion</td>
<td>All four cases</td>
<td>ASCE/SEI 7-10 Section 12.9.5</td>
</tr>
<tr>
<td>Strength Load Combinations</td>
<td>$(1.2+0.2S_{DS})D+\rho E+0.5L+0.2S$</td>
<td>ASCE/SEI 7-10 Section 12.4.2.3</td>
</tr>
<tr>
<td></td>
<td>$(0.9-0.2S_{DS})D+\rho E$</td>
<td></td>
</tr>
<tr>
<td>Drift Ratio</td>
<td>No Limit</td>
<td>Drift limits enforced at $MCE_R$</td>
</tr>
</tbody>
</table>

Note: Base shear for modal response spectrum analysis scaled to 100% of base shear for equivalent lateral force procedure. ASCE/SEI 7-10 Section 12.9.4.1 only requires scaling to 85%; however, this factor is known to increase to 100% in the next code cycle of ASCE/SEI 7 (ASCE/SEI 7-16).

$MCE_R$ Seismic Criteria

While the design-level seismic criteria establish a minimum building strength, additional checks are performed at the $MCE_R$ to ensure adequate ductility in deformation-controlled actions and protection of force-controlled actions. In general, the $MCE_R$ seismic criteria target a collapse prevention performance objective by adopting criteria from several sources of performance-based seismic design including ASCE/SEI 41-13, the 2014 Los Angeles Tall Building Structural Design Council document, and Chapter 16 of the upcoming ASCE/SEI 7-16. Although ASCE/SEI 7-10
only requires that buildings not cross the property line under the design-level event, a more stringent criteria is proposed here because of the potential for building pounding at MCE<sub>R</sub>. Pounding is known to be detrimental to building performance, especially when floor levels of the two buildings do not coincide in elevation (i.e., one building’s floor may come in contact with the other building’s column). As mentioned in the section entitled “Site Description”, a new concrete building is also under design in the adjacent property and will have floor levels which do not align with those in Framework. Therefore, a displacement limit at MCE<sub>R</sub> is enforced.

**Table 3. General MCE<sub>R</sub> seismic criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis Procedure</td>
<td>Nonlinear Response History</td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>PERFORM-3D Version 5</td>
<td></td>
</tr>
<tr>
<td>P-Delta Effects</td>
<td>Considered</td>
<td></td>
</tr>
<tr>
<td>Ground Motions</td>
<td>11 two-component ground motions spectrally matched to a 5% damped MCE&lt;sub&gt;R&lt;/sub&gt; spectrum</td>
<td>Percentage of motions will be selected to reflect the hazard contribution from the different tectonic regimes (i.e., shallow crustal versus subduction). Ground motions to be applied to building model for one set of axes. Analyses with multiple axes/orientations will not be pursued.</td>
</tr>
<tr>
<td>Deformation-Controlled Actions</td>
<td>See Table 4</td>
<td></td>
</tr>
<tr>
<td>Force-Controlled Actions</td>
<td>γ<em>I&lt;sub&gt;e&lt;/sub&gt;</em>(Q&lt;sub&gt;u&lt;/sub&gt;-Q&lt;sub&gt;ns&lt;/sub&gt;) + Q&lt;sub&gt;ns&lt;/sub&gt; ≤ Q&lt;sub&gt;e&lt;/sub&gt;</td>
<td>Reference ASCE/SEI 7-16 Section 16.4.2.1</td>
</tr>
<tr>
<td>Inherent Damping</td>
<td>Less than or equal to 2.5%</td>
<td>Reference ASCE/SEI 7-16 Section 16.3.5. Inherent damping to be distributed between modal and Rayleigh damping as recommended in PERFORM-3D User Guide.</td>
</tr>
<tr>
<td>Accidental Torsion</td>
<td>Not evaluated</td>
<td>Accidental torsion is checked at design-level. Furthermore, the 2014 LATBSDC does not require consideration of accidental torsion at this hazard level for regular buildings.</td>
</tr>
<tr>
<td>Strength Load Combination</td>
<td>D+0.2L₀</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Load combination per ASCE/SEI 7-16 Section 16.3.2. L₀ is the unreduced live load in accordance with ASCE/SEI 7-10 Chapter 4.</td>
<td></td>
</tr>
<tr>
<td>Drift Ratio Limit</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drift ratio limit taken as 1.5x those prescribed in ASCE/SEI 7-10 Table 12.12-1</td>
<td></td>
</tr>
<tr>
<td>Displacement Limit</td>
<td>Stay within East and South property lines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ASCE/SEI 7-10 Section 12.12.3 only requires that the building not cross the property line under the design-level event. For reasons described above, a more stringent limit is applied.</td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Criteria for deformation-controlled actions under MCE<sub>R</sub> seismic hazard

<table>
<thead>
<tr>
<th>Component</th>
<th>Action</th>
<th>Criteria&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Shaped Flexural Plate (UFP) Connectors</td>
<td>Flexure</td>
<td>suite mean $\Delta u \leq 0.75*\Delta_{\text{limit}}$</td>
<td>$\Delta_{\text{limit}}$ taken as the distance from nearest bolt/weld to point of tangency for the bend Value of 0.75 taken from ASCE/SEI 41-13 Section 7.6.3 for collapse prevention performance of primary components</td>
</tr>
<tr>
<td>CLT Crushing at Wall Toe</td>
<td>Axial</td>
<td>suite maximum $\varepsilon_u \leq \varepsilon_{\text{limit}}$</td>
<td>$\varepsilon_{\text{limit}}$ based on valid range of modeling from CLT crushing tests to be completed. See section entitled “Proposed Experimental Testing”.</td>
</tr>
<tr>
<td>Post-Tensioned Threaded Rods</td>
<td>Axial</td>
<td>suite mean $\varepsilon_u \leq 0.75*\varepsilon_{\text{limit}}$</td>
<td>$\varepsilon_{\text{limit}}$ based on fracture strain of threaded rods Value of 0.75 taken from ASCE/SEI 41-13 Section 7.6.3 for collapse prevention performance of primary components</td>
</tr>
</tbody>
</table>

<sup>1</sup> Suite mean calculated as average of response quantity over all ground motion records

<sup>2</sup> Suite maximum calculated as maximum of response quantity over all ground motion records
Table 5. Criteria for force-controlled actions under MCE$_R$ seismic hazard

<table>
<thead>
<tr>
<th>Component</th>
<th>Action</th>
<th>Criteria$^{1,2,3,4}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced Concrete Mat Foundation</td>
<td>Flexure</td>
<td>suite mean $M_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td></td>
<td>Shear</td>
<td>suite mean $V_u$, $\gamma = 1.5$</td>
</tr>
<tr>
<td>CLT Walls</td>
<td>Axial-Flexural</td>
<td>suite mean $(P_u, M_u)$, $\gamma = 1.0$</td>
</tr>
<tr>
<td></td>
<td>Shear</td>
<td>suite mean $V_u$, $\gamma = 1.5$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suite maximum $V_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td>CLT Wall-to-Wall Connections</td>
<td>Flexure</td>
<td>suite mean $Q_u$, $\gamma = 1.5$</td>
</tr>
<tr>
<td></td>
<td>Shear</td>
<td>suite mean $Q_u$, $\gamma = 1.5$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suite maximum $Q_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td>CLT Wall-to-Floor and Wall-to-Foundation Connections</td>
<td>Shear</td>
<td>suite mean $Q_u$, $\gamma = 1.5$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suite maximum $Q_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td>Diaphragm Chords and Collectors</td>
<td>Axial</td>
<td>suite mean $Q_u$, $\gamma = 1.5$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suite maximum $Q_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td>UFP Connections to CLT Wall and GLT Column</td>
<td>Shear</td>
<td>capacity design to ultimate strength of UFP</td>
</tr>
<tr>
<td>Post-Tensioned Rod-to-Foundation Connection</td>
<td>Axial</td>
<td>suite mean $Q_u$, $\gamma = 2.0$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suite maximum $Q_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td>Post-Tensioned Rod-to-Wall Connection</td>
<td>Axial</td>
<td>suite mean $Q_u$, $\gamma = 1.5$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suite maximum $Q_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td>GLT Lateral Columns</td>
<td>PMM</td>
<td>suite mean $P_u$, $\gamma = 2.0$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>suite maximum $P_u$, $\gamma = 1.0$</td>
</tr>
<tr>
<td>Gravity Connections</td>
<td>All</td>
<td>No loss of gravity-carrying capacity under expected lateral drifts (deformation compatibility)</td>
</tr>
<tr>
<td>Façade</td>
<td>All</td>
<td>No falling hazard. Damage to façade not otherwise limited.</td>
</tr>
</tbody>
</table>
Stair Stringer Support Displacement

$2.0 \times \text{suite mean } \Delta u \leq L_{\text{support}}$

suite maximum $\Delta u \leq L_{\text{support}}$

1. Refer to Table 3 and ASCE/SEI 7-16 Section 16.4.2.1 for $Q_u$ and $\gamma$
2. Suite mean calculated as average of response quantity over all ground motion records
3. Suite maximum calculated as maximum of response quantity over all ground motion records
4. All demands may be limited by capacity-design procedures, where a well-defined mechanism can be identified

ADDITIONAL VOLUNTARY CRITERIA

This section lists additional criteria which, although not necessary to demonstrate code equivalent performance, are pursued to meet the sustainability and resilience goals for this project. As mentioned previously, while the criteria are included in this document for reference, peer review comments solely related to the following additional, voluntary criteria are not intended to be formalized/issued to the Authority Having Jurisdiction (State of Oregon).

Service-Level Wind Criteria

The service-level wind event is taken as the wind velocity corresponding to a 25 year mean recurrence interval. However, the 3-second gust velocity is used for evaluating drifts while the mean hourly velocity is used for accelerations. As a reminder, the wind loads in ASCE/SEI 7-10 used for strength design are based on a 3-second gust velocity corresponding to a 700 year mean recurrence interval. The 3-second gust velocity corresponding to a 25 year mean recurrence interval, and the associated pressures, were provided by the site-specific wind study performed by International Climatic Evaluations Incorporated. This velocity can be converted to a mean hourly wind velocity using ASCE/SEI 7-10 Equation 26.9-16.

Table 6. Service-level wind criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis Procedure</td>
<td>Linear Static</td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>ETABS 2016</td>
<td></td>
</tr>
<tr>
<td>Load Combination</td>
<td>D+0.5L+W</td>
<td>ASCE/SEI 7-10 Equation CC-3</td>
</tr>
<tr>
<td>Drift Ratio Limit</td>
<td>0.2% for 3-second gust velocity</td>
<td></td>
</tr>
<tr>
<td>Peak Along-Wind Acceleration</td>
<td>0.015g for mean hourly velocity at residential floors</td>
<td>Procedure available in ASCE/SEI 7-10 Section C26.9 will be used to estimate peak along-wind acceleration</td>
</tr>
<tr>
<td></td>
<td>0.020g for mean hourly velocity at office floors</td>
<td></td>
</tr>
</tbody>
</table>
Base Rocking  No uplift for 3-second gust velocity

Service-Level Seismic Criteria

The service-level seismic hazard is taken as a 2.5% damped response spectrum having a 43 year return period. It was determined that the service-level response spectra was always less than the design-level hazard reduced by the response modification factor, R. Therefore the requirements for the design-level hazard will result in essentially elastic performance under the service-level hazard and it would be redundant to also evaluate the structure under the service-level hazard. The only check performed at the service-level hazard is that no base rocking occurs, similar to the criteria proposed for the service-level wind evaluation.
Repairability Seismic Criteria

While performance of the majority of the deformation- and force-controlled components are assured via the MCE\textsubscript{R} evaluation, several additional criteria are necessary to achieve a repairable building under a seismic hazard having a 475 year return period (equivalent to a probability of exceedance of 10% in 50 years). These criteria are shown below in Table 7.

Table 7. Repairability seismic criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis Procedure</td>
<td>Nonlinear Response History</td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td>PERFORM-3D Version 5</td>
<td></td>
</tr>
<tr>
<td>P-Delta Effects</td>
<td>Considered</td>
<td></td>
</tr>
<tr>
<td>Ground Motions</td>
<td>11 two-component ground motions spectrally matched to 5% damped 475 year return period target spectrum</td>
<td>Reference Table 3</td>
</tr>
<tr>
<td>Inherent Damping</td>
<td>Less than 2.5%</td>
<td>Reference Table 3</td>
</tr>
<tr>
<td>Strength Load Combination</td>
<td>(D+0.2L_0)</td>
<td>Reference Table 3</td>
</tr>
<tr>
<td>Residual Drift</td>
<td>Suite median less than 0.2%</td>
<td>Limit taken from FEMA P58-1 Table C-1 for Damage State 1. Suite median used instead of suite mean because it is recognized that residual drifts can be highly variable between ground motion records.</td>
</tr>
<tr>
<td>Post-Tensioned Threaded Rods</td>
<td>No yielding for suite median</td>
<td>Considered deformation-controlled for MCE\textsubscript{R} but force-controlled here</td>
</tr>
<tr>
<td>CLT Wall Toe</td>
<td>No crushing for suite median</td>
<td>Considered deformation-controlled for MCE\textsubscript{R} but force-controlled here</td>
</tr>
</tbody>
</table>
DELIVERABLE 14
Structural, CD Drawings (100% CD)

June 15, 2017

Report Deliverables:
   A. CD Drawings (100% CD)
   B. Final Permit Report

Produced by: KPFF
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REPORT DELIVERABLE 14-A:
CD Drawings (100% CD)
1. Shop drawings shall be submitted to the architect prior to fabrication and construction of all structural items. Design drawings shall be accompanied by calculated prints, structural calculations, and test data. Reinforcement drawings shall bear the signature of a registered structural engineer.

2. The contractor shall coordinate seismic resistances of mechanical, plumbing, and electrical systems with the structural engineer to ensure compatibility. Drawing sheets shall be standards 24x36 and shall be provided with dimensions, notes, and title blocks.

3. Minimum clear cover shall be provided for all structural items, in accordance with the structural engineer's specifications. All rebars shall be supported on at least 2.5" of well-cured concrete blocks or approved metal or plastic spacers.

4. Concrete mix designs shall be submitted with test data compliant with ACI 318-11 and shall be approved by the architect. Portland cement content may be replaced up to 20% with flyash conforming to ASTM C618 (IAPMO ES-0319) or approved with a current evaluation approval report.

5. Steel fasteners shall be Type 304 stainless steel or equivalent, with a minimum yield strength of 36 ksi. Lapsplice shall conform to ASTM A706. Welding shall comply with AWS D1.4. Column spirals shall be welded with #16 annealed iron wire. Other spirals may be welded as noted on the drawings. Lap splice lengths may be reduced for smaller bars when spliced in different bar sizes.

6. bustion tests performed per ACI 318-11 and shall be approved by the architect. All tests shall be standard cylinder tests performed per ASTM C39. Mix designs shall be as follows:

- **#5** 22 18 20 16 18 14
- **#4** 24 20 20 16 18 14
- **#4** 24 16 20 16 18 14
- **#3** 28 22 20 18 20 14
- **#2** 32 24 20 18 20 14
- **#1** 36 28 20 18 20 14

*Notes:*
- **Concrete:** The amount of cement is substituted in higher strength mixes or at different ratios, the mix strength must be confirmed with a current evaluation approval report.
- **Concrete:** The mix strength must be confirmed with a current evaluation approval report.
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REINFORCING STEEL: SHALL HAVE PROTECTION AS FOLLOWS:

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>PROTECTION</th>
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</thead>
<tbody>
<tr>
<td>#3</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>#4</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>#5</td>
<td>1 1/8&quot;</td>
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REINFORCING STEEL: CONCRETE COVER

<table>
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<tr>
<th>BAR SIZE</th>
<th>COVER</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>#4</td>
<td>1 1/4&quot;</td>
</tr>
<tr>
<td>#5</td>
<td>1 3/8&quot;</td>
</tr>
</tbody>
</table>

CONCRETE ACCESSORIES:

- Embedded steel bars shall be minimum 3/4" diameter with #3 rebar or larger.
- Embedding at least three bars per stud shall be required as specified on the plan.
- Embedding shall be made in accordance with the manufacturer's instructions and in accordance with ACI 318.

POST INSTALLED CONCRETE ANCHORS

- All post-installed concrete anchors shall be used in accordance with the manufacturer's recommendations and product specifications. Embedments specified on drawings are "EFFECTIVE" embedments. Spacing as wall reinforcing. Provide corner bars to match the horizontal wall aggregate to which sufficient water has been added to cause the mixture to flow without segregation. 
- Minimum of 21 days after casting. In accordance with ACI 318-11 Section D.2.2 adhesive anchors shall not be installed for a period of at least 28 days after the completion of installation.
- Requests for anchor substitutions shall be submitted to the EOR in writing along with evidence of the substitution.

CASTING:

- Concrete shall be cast against and exposed to earth 3 inches (75 mm) from the face of the block, except for the bottom of the mat slab, which shall be cast against and exposed to earth 2 inches (50 mm) from the face of the block.
- Cleanouts shall be located at all cores containing reinforcement.
- The maximum gROUT pour height shall be 12'-8". Cleanouts are required for any pour height in excess of 2'-0".
- FULLY GROUT all structural masonry walls unless noted otherwise.
- In continuous masonry such that the distance between joints does not exceed the lesser of A) 12'-0" or B) the maximum joint length at the joint location.
- Walls shall be reinforced as shown on the plans and details, and if not shown shall be reinforced in accordance with ACI 318-11 Section D.2.2 and OSHA Section 2105. Walls shall be reinforced as shown on the plans and details, and if not shown shall be reinforced in accordance with ACI 318-11 Section D.2.2 and OSHA Section 2105.

WOOD STRUCTURAL PANELS:

- All field cutting of studs must be by sawing, shearing, or plasma cutting. Other cutting methods are not permitted to be used. Welding shall conform with AWS D1.3.
- Cold-formed metal framing shall be of the size, gauge, and spacing shown on the drawings. The steel stud manufacturer's association's recommendations shall be followed.
- All lumber in contact with concrete or CMU shall be pre-weather treated, unless an approved pressure treated method is used.
- The maximum embedment depth of nails shall be as specified on the drawings. TYPICAL LAP SPLICE LENGTH SCHEDULE (IN.):

<table>
<thead>
<tr>
<th>STUD SIZE</th>
<th>LAP LENGTH</th>
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<tbody>
<tr>
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GENERAL STRUCTURAL NOTES CONT.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>TYPICAL LAY SPACE LENGTH SCHEDULE (IN.)</th>
<th>NAIL TYPE</th>
<th>NAIL CHARTER</th>
<th>MINIMUM RESISTANCE TO PROXIMITY-WELDED (PSI)</th>
<th>MINIMUM RESISTANCE TO PROXIMITY-LEAD (PSI)</th>
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<tr>
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<td>362</td>
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<tr>
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<tr>
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FRAMING NAILS

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<tr>
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<td>FAS</td>
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CONCRETE SCREW

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<tr>
<th>CONCRETE SCREW</th>
<th>RATED STURD-I-FLOOR, EXTERIOR OR EXPOSURE 1, OF THE THICKNESS AND SPAN RATING SHOWN ON THE DRAWING</th>
<th>note1</th>
<th>note2</th>
</tr>
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<tbody>
<tr>
<td>WELLS HILTI X-U (ESR-2269)</td>
<td>1,500 PSI CASE 1 CASE 2</td>
<td>1,500 PSI CASE 1 CASE 2</td>
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<tr>
<td>HILTI KIWIK-FLEX (ESR-3332)</td>
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</tr>
<tr>
<td>HILTI HIT-HY200 (ESR-3187)</td>
<td>1,500 PSI CASE 1 CASE 2</td>
<td>1,500 PSI CASE 1 CASE 2</td>
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<tr>
<td>SIMPSON TITEN HD (ICC ESR-2713)</td>
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<td>1,500 PSI CASE 1 CASE 2</td>
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<tr>
<td>SIMPSON SET-XP (ICC ESR-2508)</td>
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<td>1,500 PSI CASE 1 CASE 2</td>
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CONCRETE MASONRY ASSEMBLY STRENGTH

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<th>MATERIAL</th>
<th>FLEXURAL STRENGTH FV,G,K (MPA)</th>
<th>ELASTICITY MODULUS E (MPA)</th>
<th>TYPICAL LAP SPLICE LENGTH SCHEDULE (IN.)</th>
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<tr>
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<tr>
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<tr>
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<td>162</td>
<td>162</td>
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<td></td>
</tr>
</tbody>
</table>

NOTES (CONT.)

- Notwithstanding anything contained herein, the requirements for Architectural Glulam shall be in accordance with the American National Standard for Structural Glued Laminated Timber or EN 14080: 2013, Timber Glulam Beams and Columns.
- All-glue laminated beams shall be certified in accordance with the American National Standard for Structural Glued Laminated Timber or EN 14080: 2013, Timber Glulam Beams and Columns.
- All glulam beams and columns shall conform to Architectural Glulam standard or SIMPSON ACCESSORIES. Allowable loads for the SIMPSON accessories shall be found in the SIMPSON ACCESSORIES catalog or through the manufacturer.
- All lumber in contact with concrete or CMU shall be post-instilled with standard cut anchors.
- The requirements for glulam beams and columns shall be in accordance with the American National Standard for Structural Glued Laminated Timber or EN 14080: 2013, Timber Glulam Beams and Columns.
- All glulam beams and columns shall be post-instilled with standard cut anchors.
CROSS LAMINATED TIMBER PANELS

CROSS LAMINATED TIMBER (CLT) MEMBERS SHALL BE MANUFACTURED IN CONFORMANCE WITH ANSI/APA PRG 320-2012 STANDARD FOR PERFORMANCE-RATED CROSS-LAMINATED TIMBER AND APA PRODUCT REPORT PR-L314. OR EQUIVALENT. DEMONSTRATION OF EQUIVALENCE SHALL BE RESPONSIBILITY OF THE MANUFACTURER.

PANELS SHALL BE INDUSTRIAL (HIDDEN) OR ARCHITECTURAL (EXPOSED) WITH LAYUPS AS NOTED ON THE STRUCTURAL PLANS AND OF THE STRENGTHS INDICATED BELOW.

CROSS LAMINATED TIMBER (CLT) PANELS - MINIMUM ALLOWABLE DESIGN PROPERTIES

<table>
<thead>
<tr>
<th>LAYUP#</th>
<th>THICKNESS (IN)</th>
<th>MINOR STRENGTH DIRECTION</th>
<th>MAJOR STRENGTH DIRECTION</th>
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<tr>
<td>CLT5 FLOOR PANELS</td>
<td>6.875</td>
<td>1,890</td>
<td>1,100</td>
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<tr>
<td>CLT7 WALL PANELS</td>
<td>9.625</td>
<td>2,100</td>
<td>875</td>
</tr>
</tbody>
</table>

CLT CONNECTIONS, SPLINES AND FASTENERS SHALL BE AS SHOWN IN THE STRUCTURAL DRAWINGS OR AS APPROVED BY THE SER. UNLESS OTHERWISE NOTED IN PLAN, CLT PANELS SHALL BE ORIENTED WITH EXTERIOR LAYERS PERPENDICULAR TO SUPPORTS. FIELD NOTCHING AND BORING OF CLT PANELS IS NOT ALLOWED UNLESS APPROVED BY SER.

SELF-DRILLING SCREWS

SELF-DRILLING SCREWS FOR WOOD AND WOOD TO STEEL CONNECTIONS SHALL BE AS SHOWN IN THE STRUCTURAL DRAWINGS FROM THE FOLLOWING APPROVED MANUFACTURERS.

<table>
<thead>
<tr>
<th>SCREW TYPE</th>
<th>MANUFACTURER</th>
<th>ICC REPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDS SERIES WOOD (SDS)</td>
<td>SIMPSON STRING-TIE</td>
<td>ESR-2236</td>
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<tr>
<td>MyTiCon TIMBER CONNECTORS</td>
<td>ESR-3178 &amp; ESR-3179</td>
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<tr>
<td>SWG ASSY STRUCTURAL SCREWS (ASSY 3.0/4VG)</td>
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</table>

BUILDING RESPONSE INSTRUMENTATION

BUILDING RESPONSE INSTRUMENTATION SHALL BE INSTALLED TO MEASURE POST-TENSIONING LOSS AND EARTHQUAKE ACCELERATIONS.

POST-TENSIONING LOSS INSTRUMENTATION SHALL INCLUDE PERMANENT MEASURING DEVICES AT THE TOP OF THE P/T RODS AND SHALL BE INSTALLED PRIOR TO ANY POST-TENSIONING OPERATIONS. ACCESS TO DATA AND TO MEASURING DEVICES SHALL BE MAINTAINED AT ALL TIMES.

EARTHQUAKE RECORDING INSTRUMENTATION SHALL INCLUDE PERMANENT ACCELEROMETERS, AS FOLLOWS:

1. (1) TRI-AXIAL SENSOR AND (1) UNIAXIAL SENSOR LOCATED AT LEVEL 1
2. (1) BIAXIAL SENSOR AND (1) UNIAXIAL SENSOR LOCATED AT LEVEL 3, 6, 9 AND ROOF

ACCELEROMETERS SHALL BE INTERCONNECTED FOR COMMON START, TIMING AND RECORDING. ACCESS TO DATA AND TO ACCELEROMETERS SHALL BE MAINTAINED AT ALL TIMES. A SIGN STATING "MAINTAIN CLEAR ACCESS TO THIS INSTRUMENT" SHALL BE POSTED IN A CONSPICUOUS LOCATION FOR EACH ACCELEROMETER AND THE DATA RECORDER.
## SPECIAL INSPECTIONS

<table>
<thead>
<tr>
<th>TABLE 1 - REQUIRED GEOTECHNICAL SPECIAL INSPECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM OR MATERIAL</td>
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<tr>
<td>SOILS</td>
</tr>
<tr>
<td>GEOTECHNICAL REPORT</td>
</tr>
<tr>
<td>BY THE GEOTECHNICAL ENGINEER</td>
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<table>
<thead>
<tr>
<th>TABLE 2 - STRUCTURAL SPECIAL INSPECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM OR MATERIAL</td>
</tr>
<tr>
<td>--------------------</td>
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<tr>
<td>CONCRETE</td>
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<tr>
<td>SPECIAL INSPECTION</td>
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<tr>
<td>CONDUCTED FOR STRUCTURAL MEMBERS AND FABRICATORS X</td>
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<tr>
<td>EQUIPMENT X</td>
</tr>
<tr>
<td>FABRICATORS</td>
</tr>
<tr>
<td>BY THE SYSTEMS ENGINEER</td>
</tr>
</tbody>
</table>

### Reminders

- Documentation and inspection reports should be submitted within 7 days of completion.
- All non-structural elements should be identified and verified for compliance with structural documents before review.
- Quality assurance and quality control (QA/QC) are required for all items unless specified otherwise.
- Inspections are required for the following:
  - Special inspections of structural members and fabricators
  - Special inspections of concrete
  - Special inspections of steel and reinforcing steel

### Special Inspections

- Special inspections are required for:
  - Structural members and fabricators
  - Special inspections of concrete
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### Notes

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### Table 1 - Required Geotechnical Special Inspections

<table>
<thead>
<tr>
<th>System or Material</th>
<th>OBS Code Reference</th>
<th>Code of Standard Reference</th>
<th>Continuous</th>
<th>Periodic</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Soils</td>
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<tr>
<td>Geotechnical Report</td>
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<tr>
<td>By the Geotechnical Engineer</td>
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</table>

### Table 2 - Structural Special Inspections

<table>
<thead>
<tr>
<th>System or Material</th>
<th>OBS Code Reference</th>
<th>Code of Standard Reference</th>
<th>Continuous</th>
<th>Periodic</th>
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<tbody>
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<td>Equipment X</td>
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<td>Fabricators</td>
<td>1502.2</td>
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<tr>
<td>By the Systems Engineer</td>
<td></td>
<td></td>
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</tbody>
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### Notes

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### Special Inspections

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  - Special inspections of steel and reinforcing steel

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<th>Periodic</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Soils</td>
<td>X</td>
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<tr>
<td>Geotechnical Report</td>
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<tr>
<td>By the Geotechnical Engineer</td>
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### Table 2 - Structural Special Inspections

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<th>System or Material</th>
<th>OBS Code Reference</th>
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### TABLE 2 - REQUIRED STRUCTURAL SPECIAL INSPECTIONS

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<td>ASME, ASTM, AASHTO standards</td>
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### TABLE 2A - REQUIRED STRUCTURAL STEEL SPECIAL INSPECTIONS

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**Steel Structural Welding**

- **Verifying Use of Proper WPS's**
  - AISC 360 N3.2
  - All welds visually inspected per AWS D1.1 6.9

- **Verifying Welder Qualifications**
  - AWS D1.1 6.9
  - All welds visually inspected for AWS D1.1 6.9

- **Complete Final Drawings**
  - AWS D1.1 6.9
  - All welds visually inspected for AWS D1.1 6.9

- **Evaluating Workmanship of Welded Connections**
  - AWS D1.1 6.9
  - All welds visually inspected for AWS D1.1 6.9

**Concrete Reinforcing Steel Welding**

- **Evaluating Workmanship of Welded Connections**
  - AWS D1.1 6.9
  - All welds visually inspected for AWS D1.1 6.9

**High-Strength Bolting**

- **Snug-Tight High Strength Bolt Installation**
  - RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts
  - All connections visually inspected and verified snug

- **Pretensioned High Strength Bolt Installation**
  - Using Turn-Of-The-Nut Method with Match Marking, Direct Tension Indicator Method, or Twist-Off Type Tension Control Bolt Method
  - All connections visually inspected. Connections using direct tension indicators, all bolts shall be inspected after snugging and after pretensioning

**Inspection Tasks Prior to Bolting**

- **Manufacturer's Certifications Available for Fastener Materials**
  - Fasteners marked in accordance with ASTM requirements

- **Proper Fasteners Selected for the Joint Detail**
  - Grade, Type, Bolt Length, if threads are to be excluded from the shear plane

- **Proper Bolting Procedure Selected for Joint Detail**

- **Proper Storage Provided for Bolts, Nuts, Washers and Other Fastener Components**

**Inspection Tasks During Bolting**

- **Bolter Instructions Available for Extended Nut Bolting**

- **FASTENER ASSEMBLIES, OF SUITABLE CONDITION, PLACED IN ALL HOLES AND WASHERS (IF REQUIRED) ARE POSITIONED AS REQUIRED**

- **Bolter Instructions Available for Extended Nut Bolting**

- **PROPER FASTENERS SELECTED FOR THE JOINT DETAIL (GRADE, TYPE, BOLT LENGTH, IF THREADS ARE TO BE EXCLUDED FROM THE SHEAR PLANE) X**

- **PROPER BOLTING PROCEDURE SELECTED FOR JOINT DETAIL X**

- **PROPER STORAGE PROVIDED FOR BOLTS, NUTS, WASHERS AND OTHER FASTENER COMPONENTS X**

**Inspection Tasks After Bolting**

- **Document Acceptance or Rejection of Bolted Connections**

- **FASTENER ASSEMBLIES OF SUITABLE CONDITION PLACED IN ALL HOLES AND WASHERS OF FASTENERS ARE POSITIONED AS REQUIRED**

- **FASTENER ASSEMBLIES ARE MAINTAINED IN THE WRENCHING AND CONDITIONS DURING BOLTING**

- **FASTENERS ARE PRETESTED AND MAINTAINED IN ACCORDANCE WITH THE RCSC SPECIFICATION, PROGRAMMATICALLY FROM THE MOST RIGID POINT TOWARDS THE FREE EDGES**

- **SELECTED FASTENERS ARE TIGHTENED**

- **EACH CONNECTION VISUALLY INSPECTED FOR UNIVERSE HEADS**
### TABLE 3 - REQUIRED SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

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### TESTING

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<td>FABRICATOR SPECIFIED AT TIME FRESH CONCRETE PLACED</td>
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EXHIBIT 2

HIGH ROOF FLOOR LOADING PLAN

1/8" = 1'-0" HIGH ROOF FLOOR LOADING PLAN

SOIL DL = 22 PSF
LL = 20 PSF
SL = 25 PSF

*4" SOIL DEPTH (64 FCF MAX.)

NOT FOR CONSTRUCTION AS INDICATED

C:\REVIT\215135-Framewooc STRUCT-16_chrisb.rvt
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Sheet Notes:

1. For general structural notes and abbreviations, refer to S00X series.
2. For typical roof framing details, refer to S72X series.
3. Verify all dimensions, elevations, slopes, drain locations, and other details with architectural drawings prior to the start of construction.
4. Verify elevator openings and pit dimensions with elevator manufacturer prior to the start of construction.
5. Refer to architectural, mechanical, and electrical engineering drawings as referenced by the architect and structural engineer. Dimensions and coordination with structural drawings are the design responsibility of other.
6. Specifications and detailing of all waterproofing and drainage items, although indicated on the structural drawings for information purposes only, are the design responsibility of other.
7. Indicates top of sheathing elevation, relative to typical top of finished ground floor elevation = X'-X", where 100'-0" = USGS 36'-7".
8. (S) indicates slope in structural framing.
9. (ST) indicates step in elevation.
10. Indicates bearing stud wall below.

Not for Construction as indicated.
NOT FOR CONSTRUCTION

1. INDICATES ADD'L. TOP REINFORCING.
2. INDICATES ADD'L. BOTTOM REINFORCING.
3. (T) INDICATES TOP.
4. (B) INDICATES BOTTOM.
5. PROVIDE #5 SHEAR TIES @ 8" o.c.
6. REF. ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR SLEEVES, BLOCKOUTS AND OTHER ITEMS TO BE COORDINATED WITH THE STRUCTURAL DRAWINGS.
7. REF. SHEETS S501 THRU S504 FOR TYP. REINFORCING AND P/T DETAILS.

S201

DATE: NOVEMBER 4, 2016

PROJECT NUMBER: 215135

SCALE: AS INDICATED

SHEET TYPE: FOUNDATION BOTTOM REINFORCING PARTIAL PLANS
NOTES:

1. INDICATES ADD'L. TOP REINFORCING.
   REF. DETAIL 10/S511 FOR LAYOUT AND SPACING.

2. INDICATES ADD'L. BOTTOM REINFORCING.
   REF. DETAIL 10/S512 FOR LAYOUT AND SPACING.

3. (T) INDICATES TOP.

4. (B) INDICATES BOTTOM.

5. PROVIDE #5 SHEAR TIES @ 8" O.C.
   REF. S503 FOR TYPICAL SHEAR TIE SPACING.

6. REF. ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR SLEEVES,
   BLOCKOUTS AND OTHER ITEMS TO BE COORDINATED WITH THE STRUCTURAL
   DRAWINGS.

7. REF. SHEETS S501 THRU S504 FOR TYP. REINFORCING AND P/T DETAILS.

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1. IN DICATES ADD'L. TOP REINFORCING.
   REF. DETAIL 10/S511 FOR LAYOUT AND SPACING.

2. INDICATES ADD'L. BOTTOM REINFORCING.
   REF. DETAIL 10/S512 FOR LAYOUT AND SPACING.

3. (T) INDICATES TOP.

4. (B) INDICATES BOTTOM.

5. PROVIDE #5 SHEAR TIES @ 8" O.C.
   REF. S503 FOR TYPICAL SHEAR TIE SPACING.

6. REF. ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR SLEEVES,
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   DRAWINGS.

7. REF. SHEETS S501 THRU S504 FOR TYP. REINFORCING AND P/T DETAILS.

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1. INDICATES ADD'L. TOP REINFORCING.
   REF. DETAIL 10/S511 FOR LAYOUT AND SPACING.

2. INDICATES ADD'L. BOTTOM REINFORCING.
   REF. DETAIL 10/S512 FOR LAYOUT AND SPACING.

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4. (B) INDICATES BOTTOM.

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6. REF. ARCHITECTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS FOR SLEEVES,
   BLOCKOUTS AND OTHER ITEMS TO BE COORDINATED WITH THE STRUCTURAL
   DRAWINGS.

7. REF. SHEETS S501 THRU S504 FOR TYP. REINFORCING AND P/T DETAILS.
WEST SHEAR WALL/SHAFT

1/2" = 1'-0" SCA

NOTE:

1. INDICATES SPAN DIRECTION OF WELDED METAL BAR GRATING WITH BEARING BARS 1 1/2"x3/16" @ 1 3/16" SPACING SERRATED TO 1/4" MAX. DEPTH WITH CROSS BARS @ 4" MAX. o.c.

2. (C) INDICATES CANTILEVER.

METAL PANEL

S602 5/8" ORT FOR VACUUM PRECIPITATION REQUIREMENTS
### COLUMN SCHEDULE

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1. AT BOUNDING COLUMNS C-11, C-12 AND C-13 SHEAR WALL ELEVATIONS FOR SPLICE LOCATIONS.
2. REFER TO DETAIL S502 SIM FOR COLUMN TYPE D TO TYPE J CONNECTION.

### COLUMN SECTIONS

<table>
<thead>
<tr>
<th>COLUMN</th>
<th>TYPE</th>
<th>SIZE (in)</th>
<th>SIZE (mm)</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>A</td>
<td>18.90&quot;</td>
<td>18.90&quot;</td>
<td>480</td>
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<td>B</td>
<td>15.74&quot;</td>
<td>17.32&quot;</td>
<td>400</td>
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<td>C</td>
<td>14.17&quot;</td>
<td>18.90&quot;</td>
<td>360</td>
<td>480</td>
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<tr>
<td>D</td>
<td>14.17&quot;</td>
<td>15.75&quot;</td>
<td>360</td>
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<td>E</td>
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<td>G</td>
<td>10.24&quot;</td>
<td>12.60&quot;</td>
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<td>H</td>
<td>11.81&quot;</td>
<td>12.60&quot;</td>
<td>300</td>
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<tr>
<td>J</td>
<td>15.74&quot;</td>
<td>16.53&quot;</td>
<td>400</td>
<td>420</td>
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</table>

### CONCRETE COLUMN SECTION

- **HINGE AREA**
- **UNIT REBAR**
- **CONC. WALL WHERE OCCURS**
- **AS TIES BITS @ P+"**
- **2.25" DIA BOLTS**
- **2.25" DIA BOLTS**
- **11/4" DIA BOLTS**
- **CONCRETE COLUMN**
3. SHEAR WALL SPLICE PLAN

1. SHEAR WALL PLAN

2. SHEAR WALL SPLICE DETAIL

4. UFP CONNECTION DETAIL

5. CRUCIFORM STEEL CONNECTOR

NOTE:
1. FOR INFORMATION NOT SHOWN OR NOTED ON TYPE 3: SHEAR WALL, TYPES 1 AND 2.
2. INSTALL CRUCIFORM STEEL CONNECTORS EXPOSED INTO WALL SPLICE PANELS.
3. UFP CONNECTIONS TO BE LOCATED AND MARKED ON WALL SPLICE PANELS.
4. FOR INFORMATION NOT SHOWN OR NOTED ON TYPE 2: SHEAR WALL, TYPES 1 AND 2.

CRUCIFORM STEEL CONNECTOR

UFP PLATE

SECTION A-A

SECTION B-B

UFP TYP.” SHEAR WALL SPLICE DETAIL

UFP WALL SPLICE DETAIL

UFP SHEAR WALL SPLICE DETAIL

UFP CONNECTION DETAIL

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UFP CONNECTION DETAIL
1. PROVIDE INTUMESCENT PAINT COATING ON STEEL PLATE.
2. FILL VOID w/ WOOD INFILL BLOCK REF. ARCH.
3. PLACE BUILT UP PLATE IN 8" WIDE x 9" POCKET EPOXY IN PLACE.
4. PROVIDE INTUMESCENT PAINT COATING ON 1" BEARING PLATES, BELOW LVL 7.
5. STEEL SLEEVE 1 3/4" 5/8" 3" 1/8" COUPLER WHERE OCCURS REF. ELEVATIONS
6. 1" Ø A325 THRU BOLT TYP.
7. 1/2" SIDE PLATES

NOTE: PROVIDE INTUMESCENT COATING ON 1" BEARING PLATES, BELOW LVL 7.
1. JOINTS AT SLAB ON GRADE
   - PROVIDE JOINTS ON ALL COLUMN LINES AND AT A MAXIMUM SPACING OF 36x THE THICKNESS OF THE SLAB.
   - CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING JOINT LAYOUT FOR REVIEW AND APPROVAL BY ARCHITECT AND STRUCTURAL ENGINEER.
   - ALL JOINTS TO BE KEYED JOINTS (AT ALL RE-ENTRANT CORNERS) AND TO BE Extended 1' - 0" ACROSS JOINT.

2. JOINTS AT S.O.G.
   - PROVIDE JOINTS AT S.O.G.
   - JOINTS TO BE KEYED JOINTS (AT ALL RE-ENTRANT CORNERS) AND TO BE Extended 1' - 0" ACROSS JOINT.

3. EDGE BEAM AT ENTRY
   - PROVIDE EDGE BEAM AT ENTRY.
   - EDGE BEAM TO BE 4" TYP. BOTH TOP AND BOTTOM.

4. EDGE BEAM SECTION - AT EXT. STUD WALL
   - PROVIDE EDGE BEAM SECTION - AT EXT. STUD WALL.
   - EDGE BEAM TO BE 4" TYP. BOTH TOP AND BOTTOM.

5. EDGE BEAM SECTION - AT EXTERIOR CMU WALL
   - PROVIDE EDGE BEAM SECTION - AT EXTERIOR CMU WALL.
   - EDGE BEAM TO BE 4" TYP. BOTH TOP AND BOTTOM.

6. CONTROL JOINTS IN SLAB ON GRADE
   - PROVIDE CONTROL JOINTS IN SLAB ON GRADE.
   - JOINTS TO BE KEYED JOINTS (AT ALL RE-ENTRANT CORNERS) AND TO BE Extended 1' - 0" ACROSS JOINT.

7. EDGE BEAM AT ENTRY
   - PROVIDE EDGE BEAM AT ENTRY.
   - EDGE BEAM TO BE 4" TYP. BOTH TOP AND BOTTOM.

8. GRADE BEAM SECTION
   - PROVIDE GRADE BEAM SECTION.
   - BEAM TO BE 10" TYP. BOTH TOP AND BOTTOM.

9. SLOPED SLAB ON GRADE DETAIL
   - PROVIDE SLOPED SLAB ON GRADE DETAIL.
   - SLAB TO BE THICKER THAN THE SLAB ON GRADE.

10. INTERIOR SLAB EDGE
    - PROVIDE INTERIOR SLAB EDGE.
    - EDGE TO BE THICKER THAN THE SLAB ON GRADE.

11. THICKENED SLAB EDGE
    - PROVIDE THICKENED SLAB EDGE.
    - EDGE TO BE THICKER THAN THE SLAB ON GRADE.

12. SLAB footer
    - PROVIDE SLAB footer.
    - SLAB footer TO BE THICKER THAN THE SLAB ON GRADE.

NOTES:
- JOINTS TO BE KEYED JOINTS (AT ALL RE-ENTRANT CORNERS) AND TO BE Extended 1' - 0" ACROSS JOINT.
- JOINTS TO BE KEYED JOINTS (AT ALL RE-ENTRANT CORNERS) AND TO BE Extended 1' - 0" ACROSS JOINT.

REFERENCE:
- PLAN FOR SLAB ON GRADE DETAILS.
- PLAN FOR SLAB ON GRADE.
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EDGE BEAM SECTION - AT CONC. WALL

CONCRETE BENCH DETAIL - GRID A

CMU SITE WALL SECTION

HSS COLUMN BASE DETAILS

STAIR BASE DETAIL

8" CMU WALL CORNER DETAIL

SECTION AT RAMP

MEP HOUSEKEEPING PAD
SECTION AT NORTH BALCONY

1. GUARD RAIL POST @ 6'-0" O.C. MAX.
2. CONC. PAVER ASSEMBLY REF. ARCH.
3. HORNFRAY TO ALLOW W/ GUARD RAIL POST
4. EXTENSION METAL SHEET PANELS, EXTERIOR WALLS AND EXTERIOR MA
5. HOLLOW ELEMENTS REF. PL.
6. CONC. PAVER REF. PL.
7. CONC. WALL REF. PL.

SOUTH BALCONY DETAIL

1. GUARD RAIL POST @ 6'-0" O.C. MAX.
2. CONC. PAVER ASSEMBLY REF. ARCH.
3. HORNFRAY TO ALLOW W/ GUARD RAIL POST
4. EXTENSION METAL SHEET PANELS, EXTERIOR WALLS AND EXTERIOR MA
5. HOLLOW ELEMENTS REF. PL.
6. CONC. PAVER REF. PL.
7. CONC. WALL REF. PL.
8. CONC. WALL REF. PL.
9. CONC. COLUMN REF. BEYOND TOP OF CONC. COLUMN BEYOND 8" CONC. AND REL BEAM #5 DOWELS @ 8" O.C.
10. (2) #4 TOP CONC. BEYOND 8" CONC. SP. AND REL BEAM
11. #4 DOWELS @ 12" O.C.
12. (5) #6 TOP & BOTTOM HOOK TYP. WALL REINF. AT TOP OF WALL
13. EXTENSION COLUMN REINF. BEYOND EXTEND COLUMN REINF. BEYOND CONC. COLUMN BEYOND 12" CONT. L4x3x3/8 L.L.V.
1. MECHANICAL SCREEN DETAIL

2. MECHANICAL SCREENS MOMENT CONNECTION

3. MECHANICAL SCREEN BASE PLATE DETAIL
GUARD RAIL POST TO CLT5 CONNECTION

TRELLIS SECTION - LEVEL 12

BASE PL 3/8"x10"x0'-10" w/ (4) 3/8"Øx5 1/2" ASSY VG SCREWS

ECO ROOF OVER

GLULAM BEAM

REF. ARCH.

SECTION AA

HSS AT TRELLIS

REF. PLAN

1/4 SLOPE

REF. ARCH

CLT5 FLOOR PANEL

OR ORIENTATION VARIES

REF. PLAN

3" REF. PLAN

3' - 6" TYP.

1 1/2" TYP.

1 1/2" 8" 8"

BASE PL 3/8"x8"x0'-8" w/ (4) 3/8"Øx6 1/4" ASSY VG SCREWS

CLT FLOOR PANELS

ORIENTATION VARIES

REF. PLAN

GUARD RAIL POST

AT 6'-0" MAX.

REF. ARCH.
1. EXPOSED BEAM TO COLUMN CONNECTION - LEVEL 7 THROUGH 12

2. CLAD BEAM TO BEAM CONNECTION

3. CLAD GLULAM COLLAR BEAM TO COLLAR BEAM DETAIL

4. CLAD COLLAR BEAM TO COLUMN CONNECTION

NOT FOR CONSTRUCTION
LEVEL 1 T.O. CLT
100' - 0" Level 2 T.O. CLT
116' - 0" Level 3 T.O. CLT
128' - 0" Level 4 T.O. CLT
140' - 0" Level 5 T.O. CLT
152' - 0" Level 6 T.O. CLT
164' - 0" Level 7 T.O. CLT
176' - 0" Level 8 T.O. CLT
186' - 0" Level 9 T.O. CLT
196' - 0" Level 10 T.O. CLT
206' - 0" Level 11 T.O. CLT
216' - 0" Level 12 T.O. CLT
228' - 0"

T.O. UPPER PARAPET
248' - 0" T.O. PARAPET
242' - 0"

T.O. LOWER PARAPET
233' - 0"

NOT FOR
CONSTRUCTION

LEGEND

- WING CORNER ZONE
- WIND CORNER ZONE

1. FOR METAL STUD, HEADER, JAMB, AND SILL SCHEDULES REF. S811.
2. PROVIDE BLOCKING AT THIRD POINTS REF. S811.

DATE
NOVEMBER 4, 2016

PROJECT NUMBER
215135

SHEET TITLE
EXTERIOR WALL ELEVATIONS

SCALE
1/8" = 1'-0"

NOTES

1. FOR METAL STUD, HEADER, JAMB, AND SILL SCHEDULES REF. S811.
2. PROVIDE BLOCKING AT THIRD POINTS REF. S811.
HSS FRAME TO METAL STUDS

PARAPET SECTION AT STEEL POST

TYPICAL PARAPET

PARAPET STEEL POST

ENLARGED SECTION AT PARAPET WALL

PARAPET CORNER POST

NOTE:
REVISION

METAL STUDS

TOP TRACK

HSS 9x5

ClT SHEAR WALL

HSS 6x6 BEYOND

HSS 4x4

STEEL GRATE

TOP TRACK

TYP.

600T150-68

BO T0M TRACK TYP.

600T150-68

TY P.

HSS 5x3x1/4 POST

5' - 0"

MAX.

2024x401

HSS 6x6 CORNER POST

1/4" THICK CAP PL

HSS 6x6 SCREEN WALL SUPPORTS

S811

S812

S3

S701

4'-0" o.c. AT WIND CORNER ZONES AND 8'-0" o.c. STEEL POST

REF. 2/S811 FOR SCHEDULE

2/S813

S813

CO SCHEDULE

HEAD METAL STUD

HSS 4x4 CORNER POST

HSS 4x4

1" = 1'-0" S8 01

ENLARGED SECTION AT PARAPET WALL

PARAPET CORNER POST
STEEL COLUMN TO BEAM DETAIL

STEEL BEAM TO COLUMN AT WALL DETAIL

JAMB ABOVE HEADER DETAIL

STEEL BEAM TO JAMB DETAIL

STEEL BEAMS TO INTERIOR COLUMN

JAMB TO ROOF DETAIL

STEEL BEAM TO BEAM DETAIL

ROOF FRAMING TO STEEL BEAM DETAIL

NOT USED
REPORT DELIVERABLE 14-B:
Final Permit Report