TO: Kent Studebaker, Chair  
Members of the Redevelopment Agency

FROM: Scott Lazenby, Executive Director  
Jordan Wheeler, Deputy City Manager  
City Manager’s Office

SUBJECT: City Hall Rehabilitation Project

DATE: January 14, 2017

ACTION

Receive information on the findings of the materials analysis and seismic assessment of City Hall and provide initial direction and input on the scope of the City Hall rehabilitation project.

INTRODUCTION/BACKGROUND

The repair and replacement of the exterior walls and windows of City Hall is included as part of the Police Facility project. City Hall, value-engineered and constructed in 1986 for about $5 million, has multiple and significant building and programmatic deficiencies identified through several studies and condition assessments. The inadequate drainage system of the building, compounded by the long history of excessive amounts of rainwater penetrating through the EIFS cladding’s surface, has damaged the underlying components of the building’s exterior wall. As a result, it is no longer feasible to maintain the building envelope and the lack of drainage system coupled with the significant concealed damage under the EIFS cladding removes the possibility of doing targeted repairs. An assessment conducted in July 2015 by Morrison Hershfield recommended a full replacement of windows, doors, EIFS and underlining sheathing and insulation, roofing system, and repairs to the exterior walls.

In 2015, the City Council adopted the goal to “build funds through a set-aside in the operating budget to complete major repairs to the exterior walls and windows of City Hall,” and a longer term goal adopted in 2016 is to “replace the exterior and windows of City Hall.”

The Police Facility project immediately adjacent to City Hall presented an ideal time to address the significant issues with the building’s condition and coordinate the design of the new exterior of City Hall with the design of the new Police facility. The scope of work for the project
architect, Mackenzie, included as an initial phase, an existing conditions analysis with a goal to determine what material types and wall assemblies might be possible to replace the existing siding without triggering mandatory seismic upgrades. In their efforts to evaluate the options, Mackenzie reviewed previous studies on the building, and conducted a seismic evaluation of the existing structure at a life safety performance level. The reports are included as attachments in the following order: Seismic Assessment; Summary of Previous Seismic and Envelope Evaluation Reports; Envelope Replacement Narrative; Voluntary Upgrades Narrative; Full Seismic Upgrades Narrative; Project Cost Summary Comparison; and Itemized Construction Cost Comparison.

Mackenzie’s cost analysis for the replacement of the building envelope identified some significant differences and omissions from the 2015 preliminary estimate and is more similar to the older studies and cost estimates. The Cost Summary Comparison and Itemized Construction Cost Comparison highlights the discrepancies which included updated and more conservative estimates for hard costs, a construction cost escalation, mold remediation, design fees, and contingencies. It would be prudent that with an existing building, which has the history of significant water intrusion, to carry a substantial contingency for unforeseen circumstances, which is reflected in the more conservative estimates. If we find that there is less damage than anticipated when the building’s exterior is opened up, then the contingency wouldn’t need to be used. As a result, the difference between the preliminary estimate and Mackenzie findings is substantial but some costs may be over-estimated and conservative since we will not know the extent of the repair work until a contractor removes the skin and the extent of the interior damage is known.

The purpose of the February 7 meeting is to provide the Board with the findings of the materials analysis and seismic assessment and answer questions regarding the results of the studies. Further refinements of the costs for the options and the voluntary upgrades and retrofits are being prepared but the Board’s input and direction on the scope and if there is any additional information needed at this point would be helpful.

DISCUSSION

Mackenzie’s structural analysis found that the building was designed for the relatively light weight of the EIFS system, and other siding systems (brick, artificial brick panels, Hardieplank, etc.) would require such extensive changes to the structure of the building (basically gutting it) that it would approach the cost of a new building. Replacing the exterior with something similar to the existing system would be a practical alternative, since experience over the past thirty years has led to methods of installing an EIFS system that avoids water damage. Briefly, the new systems assume that some water will intrude at wall penetrations (vents, windows, etc.), and provide paths for the water to escape rather than pooling inside the wall (See, for example, https://buildingscience.com/documents/digests/bsd-146-eifs-problems-and-solutions).

Using a similar exterior system would limit design options, and the two buildings (city hall and police station) would not mirror each other, since we probably won’t use an EIFS system for the
police building. But the architects can propose changes to the appearance of city hall through paint choices and trim. And as long as the buildings complement each other, having some variation on the block could be good.

Some of the advantages of replacing the exterior with a similar system include:

- Cost (by far the least expensive option)
- The ability to do some seismic upgrades at relatively low cost, through tightened connections in the exterior walls and roof
- A significant improvement in heating/cooling cost through better windows and better insulation in the walls

In short, it doesn’t seem to make sense to gut the building purely for aesthetic reasons. But there may be other arguments for replacing or extensively rebuilding it, and the City Council should consider them.

Previous studies have noted that many of the buildings systems—HVAC, elevator, generator, carpeting and floor material—are reaching the end of their useful life or otherwise need to be replaced. If we would do all of these at once, some studies have suggested the cost might approach that of a new building (which would be built to current seismic standards).

On the other hand, even with a new building, these kinds of systems begin depreciating immediately. Replacement of equipment and carpet is a cost that all building owners face, whether the building is new or not.

And many of the core elements of city hall are functional. For example, a previous analysis found deficiencies in the electrical system due to the proliferation of computers and other office equipment. But converting the lights to LEDs has significantly reduced the electrical load.

There is a good chance that the studies have under-estimated the cost of a new building. In addition to HVAC, elevators, generator, siding, and carpeting, a new building would need a new foundation, structure, plumbing and electrical systems, and an expensive architectural contract. In addition, we would face moving costs, and possibly lease costs for temporary space.

Finally, as a practical matter, there aren’t good options for funding a new building. It might be possible to use LORA funds, but this would preclude many of the remaining downtown projects. A bond measure for city hall probably wouldn’t fare well when competing with bonds for school upgrades and replacements.
RECOMMENDATION

On balance, staff recommends that we direct the architect to assume that we will replace city hall’s exterior with a similar system. This recommendation, however, comes with these caveats:

1. The cost may exceed the $5 million estimate, depending on the extent to which studs, sheetrock, carpet, and other materials will need to be replaced. Mackenzie is preparing more estimates, but we won’t know the cost until we put it out to bid, and the contractor removes the outer skin.
2. We may choose to do other improvements in conjunction with the skin replacement, either due to potential cost savings, or logistically to get them done at the same time as long as office areas are being disrupted. For example, it would be a good time to repair the cracked stucco and replace some of the corroded pipes in the parking garage, even if mostly for aesthetic reasons.
3. We still need to face the cost of replacement of aging systems. Facilities Manager Rachael Peterson estimates that new elevator cars and controls will cost $1 million. Other regular maintenance needs include things such as mechanical systems, floor repairs and carpeting, and replacing the generator. The proposed 2017-18 budget will include an annual “rent” charge to city hall departments to at least partially fund these needs.
4. City Hall will not meet today’s highest seismic standards and as the building currently stands today, could pose a life safety hazard under a Cascadia level event and would not be occupiable or likely not repairable after such an event. City Hall’s performance in a seismic event could be improved depending on the type and number of voluntary seismic retrofits that are made to the building, however we don’t know if the retrofits could bring the building up to a life safety level.

ATTACHMENTS

1. City Hall Seismic Assessment
2. Summary of Previous Seismic and Envelope Evaluation Reports
3. Envelope Replacement Narrative
4. Voluntary Upgrades Narrative
5. Full Seismic Retrofit Narrative
6. Project Cost Summary Comparison
7. Itemized Construction Cost Comparison
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1. INTRODUCTION
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PROJECT TEAM

Lake Oswego City Hall
- Jordan Wheeler

Mackenzie
- Josh McDowell, SE, PE, LEED AP — Structural Principal
- Landon Harman, PE — Project Engineer
- Oliver Jim, EIT — Structural Designer
- Jeff Humphreys — Project Principal
- Caitlin Cranley — Project Manager

EXECUTIVE SUMMARY

The primary purpose of this report is in support of Mackenzie’s efforts to help the City of Lake Oswego make some informed decisions about the re-cladding of the existing City Hall building. During preliminary discussions, the question of what alternative veneer/cladding materials could be used on the building came up. Changing the material of the skin system of a building alters the seismic mass of a building and can in some cases trigger mandatory seismic upgrades. The primary purpose of this study was to determine what material types and wall assemblies may be possible without triggering mandatory seismic upgrades. The second purpose was to conduct an ASCE 41-13 seismic evaluation of the building and develop a seismic retrofit scheme which would allow for the use of heavier cladding materials.

First, an analysis of the building’s current mass was conducted to determine how much additional mass could potentially be added to the exterior skin of the building on both a global and localized basis before triggering seismic upgrades. While this task was completed, its results were nullified by the following seismic evaluation.

Following the veneer analysis, an ASCE 41-13 Tier 1 seismic evaluation of the existing City Hall building was conducted. As part of the review, a site visit was conducted on November 22th, 2016. The City Hall building was evaluated at a Life Safety Performance Level rather than an Immediate Occupancy Performance Level as it is understood the Police Department will soon be removed from the building, resulting in a change in the required performance level.

During the seismic evaluation, it became apparent that the building suffers from both global and localized seismic deficiencies. While some of these deficiencies would not have been classified as such at the time of the building’s construction (due to changes in codes and the level of seismic hazard here in Oregon over the years), it would appear that some of them would not have been permitted by the governing building code in force at that time, the 1982 Uniform
1. INTRODUCTION

Building Code (UBC). This last fact, that portions of the building may not have been in compliance with the building code at the time of its construction, likely nullifies the option to slightly increase the mass of the exterior cladding of the building without requiring seismic upgrades.

The rest of this report will: detail the veneer study performed; address the proposed approach for modifying the building’s skin system without requiring seismic upgrades; present the findings of the seismic evaluation including both global and local deficiencies; and identify one set of possible seismic retrofits. This report will then be used to help prepare a cost estimate of the seismic retrofits required to re-clad the building with something other than its existing skin system. That cost estimate is presented in a separate report.
2. VENEER STUDY
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PROVISIONS OF OSSC CHAPTER 34

As noted above, one of the original intents of this report was to determine what exterior wall assemblies might be permitted without triggering mandatory seismic upgrades. To do so, Mackenzie anticipated using provisions of Chapter 34, Existing Buildings and Structures, of the current building code, the 2014 Oregon Structural Special Code (OSSC). Section 3401.1.2 permits the replacement of existing building materials with “like materials” provided the replacement or repair of such materials does not constitute structural repairs or alterations. Mackenzie interprets this section of the building code as allowing the City Hall to be re-clad with a similar or “like” system to that which is already in place: exterior insulating finish system (EIFS).

In order to utilize another material, Section 3404.4 of the OSSC permits alterations which impact “existing structural elements carrying lateral load” provided such impacts do not constitute more than a 10% increase in the demand-to-capacity ratio of the elements. Mackenzie intended to use this provision to present the City of Lake Oswego with alternate cladding materials and wall assemblies which may have weighed slightly more than the existing EIFS wall assembly. However, the use of this provision relies on several key assumptions. First, the authority having jurisdiction (AHJ) and its building official must agree with the interpretation. In Mackenzie's experience, there is some variability amongst building officials in how this provision is interpreted and the magnitude of changes they will permit. Typically, their interpretation is based on a second assumption: that the building was in compliance with the building code when it was constructed. The purpose of this Section 3404.4 is to allow building owners to make slight modifications without overly penalizing them for changes in the building codes over time. However, buildings which were never in compliance have been identified by building officials as being ineligible to use this section.

Based on the findings of the seismic evaluation (presented later in the report), Mackenzie does not believe the building was in compliance with the 1982 UBC at the time of construction and thus would not be eligible to utilize Section 3404.4 to justify the replacement of the existing veneer system with a heavier version.

VEENIER ANALYSIS

A seismic mass takeoff and vertical force distribution were completed for the building in its current configuration. These analyses were completed both considering and excluding the first-floor podium. The hollow core planks, steel framing, and concrete slabs of the first-floor podium weigh almost as much as the rest of the upper building combined and are braced on two sides by surrounding soil. The consideration of the podium has a large impact on the vertical distribution of seismic forces through the structure. However, the allowable change in wall assembly mass was relatively consistent.
2. VENEEER STUDY

It was found that increasing the exterior wall assembly weight from its current value of ~8.3psf up to ~17psf would limit the increase in seismic forces to less than 10% at any level. These values include everything from the inside finish material through to the exterior cladding. While the original intent was to find the largest increase in wall assembly weight that would not trigger a mandatory seismic upgrade, due to the findings of the seismic evaluation and the associated interpretation of section 3404.4, Mackenzie does not anticipate such an increase in wall assembly weight would be permitted by the building official and does not recommend that this approach be pursued.
3. Seismic Assessment
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The seismic evaluation was conducted using ASCE 41-13 Seismic Evaluation and Retrofit of Existing Buildings. This document is not a code, but a nationally-recognized standard used by engineers to evaluate and retrofit existing buildings. Previously, there were two separate documents for the evaluation and retrofit of existing buildings: ASCE 31 and ASCE 41, respectively. Recently, these documents were combined into the updated version, ASCE 41-13, to help alleviate some of the inconsistencies that occurred when a building made the transition from seismic evaluation to the retrofit/upgrade process. New building codes include many provisions that require or encourage design and detailing practices that improve the seismic performance of a building, including regular building configuration, ductile detailing, and high quality materials. Most existing buildings will not meet these criteria that new construction would be designed and detailed for; however, it is recognized that these existing structural systems still have capacity that the new code doesn’t recognize. The ASCE 41-13 includes guidelines and methods for evaluating the capacities of existing structural elements that might otherwise be insufficient when analyzed using the new building code provisions.

Within the ASCE 41-13 there are four building Performance Levels (lower to higher performance): Collapse Prevention (5-E), Life Safety (3-C), Immediate Occupancy (1-B), and Operational (1-A). Unless otherwise required by code (i.e., emergency response facilities, prisons, or other essential facilities), the majority of buildings are designed for the Performance Level of Life Safety (LS). The LS performance level is meant to ensure the safety of building occupants; however, buildings with this performance level will likely experience significant damage that may or may not be repaired or occupied after the earthquake. For critical facilities that need to retain full function immediately post-earthquake to provide emergency response to the community, the building is evaluated to the higher standard of Operational. It should be noted that for structural evaluation, the Operational and Immediate Occupancy criteria are the same. The difference in the two levels is that the support systems and equipment are operational; see Figure 1. Figure 2 includes a brief summary of

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**Figure 1**

Building performance levels

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**Figure 2**

Seismic Assessment

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### 3. SEISMIC ASSESSMENT

#### Figure 2

**Damage Control and Building Performance Labels**

<table>
<thead>
<tr>
<th></th>
<th>Collapse Prevention Level (5-D)</th>
<th>Life Safety Level (3-C)</th>
<th>Immediate Occupancy Level (1-B)</th>
<th>Operational Level (1-A)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall damage</strong></td>
<td>Severe</td>
<td>Moderate</td>
<td>Light</td>
<td>Very light</td>
</tr>
<tr>
<td><strong>Structural components</strong></td>
<td>Little residual stiffness and strength to resist lateral loads, but gravity load-bearing columns and walls function. Large permanent drifts. Some exits blocked. Building is near collapse in aftershocks and should not continue to be occupied.</td>
<td>Some residual strength and stiffness left in all stories. Gravity-load-bearing elements function. No out-of-plane failure of walls. Some permanent drift. Damage to partitions. Continued occupancy might not be likely before repair. Building might not be economical to repair.</td>
<td>No permanent drift. Structure substantially retains original strength and stiffness. Continued occupancy likely.</td>
<td>No permanent drift. Structure substantially retains original strength and stiffness. Minor cracking of façades, partitions, and ceilings as well as structural elements. All systems important to normal operation are functional. Continued occupancy and use highly likely.</td>
</tr>
<tr>
<td><strong>Nonstructural components</strong></td>
<td>Extensive damage. Infills and unbraced parapets failed or at incipient failure.</td>
<td>Falling hazards, such as parapets, mitigated, but many architectural, mechanical, and electrical systems are damaged.</td>
<td>Equipment and contents generally secure but might not operate due to mechanical failure or lack of utilities. Some cracking of façades, partitions, and ceilings as well as structural elements. Elevators can be restarted. Fire protection operable.</td>
<td>Negligible damage occurs. Power and other utilities are available, possibly from standby sources.</td>
</tr>
<tr>
<td><strong>Comparison with performance intended for typical buildings designed to codes or standards for new buildings, for the design earthquake</strong></td>
<td>Significantly more damage and greater life safety risk.</td>
<td>Somewhat more damage and slightly higher life safety risk.</td>
<td>Less damage and low life safety risk.</td>
<td>Much less damage and very low life safety risk.</td>
</tr>
</tbody>
</table>

**Source:** Table C2-3, page 35; ASCE Standard – ASCE/SEI 41-13: American Society of Civil Engineers – Seismic Evaluation and Retrofit of Existing Buildings

Each performance level and the anticipated damage for a building designed to each performance level. With the removal of the Police Station and emergency call center from the existing City Hall building, its required Performance Level would fall from Immediate Occupancy to Life Safety.

ASCE 41-13 incorporates a multi-tier methodology for evaluating existing structures. Tier 1, which was chosen for this analysis, is a preliminary screening phase which utilizes a checklist approach to identify potential seismic hazards. It should be noted that at this stage, any identified risks are preliminary and may or may not be justifiable using a higher tier analysis. Tier 2 and Tier 3 are the evaluation and detailed evaluation phases, respectively, which were not conducted at this time. If a deficiency is identified in the Tier 1 screening phase, further Tier 2 or Tier 3 analysis can be used to show the specific item is acceptable. After the seismic evaluation is completed, ASCE 41-13 may be used to complete a seismic retrofit design to address issues identified in the evaluation stage. As a part of the Tier 1 screening phases, various analyses or “Quick Checks” are to be performed where specifically required. Not all items that pass the quick check will necessarily meet more detailed checks nor are they guaranteed to meet current code requirements.

The Tier 1 analysis consists of a visual survey, which was conducted on November 22, 2016. For each of the Tier 1 checklist items, an
3. SEISMIC ASSESSMENT

evaluation of Compliant (C), Non-compliant (NC), Not Applicable (N/A), or Unknown (U) is marked. NC does not necessarily mean that the issue cannot be justified with a higher tier evaluation phase; rather, only that it does not pass the Tier 1 screening criteria.

SCOPE AND LIMITATIONS

This Tier 1 analysis is based on site observations of only readily visible items and evaluation of available drawing documents listed herein. It should be noted that other deficiencies might exist that have not been identified by this screening phase and quick checks. In addition, no material or other testing was performed at this time for review. The Tier 1 quick check calculations have been performed and a more in-depth detailed analysis may be performed, though it is likely to have minimal impact on the results of this evaluation.

EXISTING BUILDING DESCRIPTION

The existing city hall building is located at 380 “A” Avenue, Lake Oswego, Oregon. The original building was built in 1986 and currently houses the Lake Oswego Police Department. The building consists of light framed walls and three cores made of reinforced concrete and masonry. The exterior walls consist of light gauge metal studs clad with Exterior Insulation and Finish System (EIFS). The roof is framed with metal-web wood trusses supported by steel beams and columns. Typical floor framing includes both metal-web wood trusses and wood I-joists supporting wood structural panels and a 1 ½” layer of gypcrete. These joists sit on steel wide flange beams that are connected to HSS columns. The first floor of the city hall is framed with concrete on metal deck supported by wide flange beams and concrete columns as seen in Figure 7. The building also includes a parking structure made of precast concrete planks, concrete walls, and concrete columns as seen in Figures 8 and 9. This first floor and the adjacent heavy parking structure act much like a podium or rigid platform for the rest of the building sitting on it. The primary lateral system of the building consists of two levels of CMU elevator/stair core walls stacked on top of concrete core walls as seen in Figures 10 and 11.

The original building documents prepared by Architect Barrentine Bates Lee and Structural Engineer VanDomelen, Looijenga & Associates, dated August 1985, were available for review along with several other building evaluations done throughout the years. Notably, a seismic assessment was completed by KPFF Consulting Engineers in September of 2006. A geotechnical report was unavailable for review.

The seismic provisions in the current Oregon Structural Specialty Code have changed significantly since the facility was originally designed, and the purpose of this report is to identify potential seismic deficiencies in the structural system.
3. SEISMIC ASSESSMENT

GLOBAL DEFICIENCIES

The existing City Hall building suffers from several key, global deficiencies in its lateral force resisting system. The building utilizes wood structural panel diaphragms with a gypcrete topping. As the gypcrete is thin and unreinforced, it can only be considered a finish and is not expected to contribute to the rigidity or strength of the floor/roof diaphragms. As a result, the diaphragms must be considered flexible when compared with the relative rigidity of concrete/masonry shear walls/cores.

The only vertical force resisting elements above the first floor are the stair cores located in the center of the building. While at the first floor the concrete on metal deck or concrete on hollow-core plank diaphragms are supported on three or four sides by concrete shear walls, the upper level diaphragms have no such support at the exterior wall. This arrangement of the vertical force resisting elements results in a highly deficient building as the flexible wood diaphragms are not expected to be capable of resisting lateral forces via rotation or torsion of the diaphragms. In fact, this mechanism was explicitly prohibited in the 1982 UBC in force at the time of construction. The worst case scenario would be north-south oriented shaking in which the western edge (and all edges) of the building is laterally unsupported allowing the diaphragm to essentially deflect until failure. While wood diaphragms have been shown to present semi-rigid characteristics in certain arrangements, this building does not have such an arrangement and significant damage could be expected under a code level seismic event.

At the first floor level, there is neither a vertical load resisting element nor a clear shear transfer load path at the transition between the elevated parking deck and the concrete on metal deck floor diaphragm of the building. This lack of continuity or support for these heavy decks may result in out of phase behavior at the first floor or the loss of gravity support for the hollow core planks at the transition. Either behavior would contribute to the poor performance of the building during a seismic event.

LOCAL DEFICIENCIES

There are limited dragstruts present in the building. Even if the wood diaphragms provided an unusually high level of torsional resistance, the dragstruts in the building are inadequate to deliver the resulting seismic forces to the building’s cores. In addition, the building lacks any clearly defined chords at the perimeter of the diaphragms. The lack of such chords combined with large expected deflections could result in significant failure of the floor and roof diaphragms in a seismic event.

Additionally, the lack of continuous cross ties between steel girders or between wood trusses is another deficiency of the building that may contribute to diaphragm failure in a seismic event. While not
as critical as the absence of dragstruts or chords (due to alternate and secondary force paths), this deficiency may magnify the effects of other building deficiencies as ties are a significant contributor to diaphragm integrity.

### MAIN BUILDING EVALUATION

#### Evaluation Criteria

This building was evaluated for a seismic event with a probability of exceedance of 10% in 50 years or a 500-year event (BSE-1) for a Performance Level of Life Safety. This is the same design earthquake ground motion hazard to which new buildings are designed. The level of seismicity was determined at the site and compared to the ASCE 41-13 level definitions; see Figure 12. For this building, SDS=0.659 and SD1=0.387; therefore, the site is in an area of high seismicity.

Based on this seismicity definition and a Life Safety performance objective, the required checklists can be determined, as seen in Figure 13. The Basic Configuration, Life Safety Structural Checklists, and Nonstructural Checklists are required. The Nonstructural Checklist will not be covered in this evaluation, and only structural elements will be discussed in the report.

ASCE 41-13 has different checklists depending on the building construction type. This building type is classified as RM1, Reinforced Masonry Bearing Walls, and C2A, Concrete Shear Walls.

#### Figure 11

CMU Walls Stacked On Concrete

#### Table 2-5. Level of Seismicity Definitions

<table>
<thead>
<tr>
<th>Level of Seismicity*</th>
<th>S_{SD}</th>
<th>S_{D}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>&lt;0.167 g</td>
<td>&lt;0.067 g</td>
</tr>
<tr>
<td>Low</td>
<td>≥0.167 g</td>
<td>≥0.067 g</td>
</tr>
<tr>
<td>Moderate</td>
<td>≥0.33 g</td>
<td>≥0.133 g</td>
</tr>
<tr>
<td>High</td>
<td>≥0.50 g</td>
<td>≥0.20 g</td>
</tr>
</tbody>
</table>

*The higher level of seismicity defined by S_{SD} or S_{D} shall govern.

**Source:** Table 2-5, page 49; ASCE Standard – ASCE/SEI 41-13: American Society of Civil Engineers – Seismic Evaluation and Retrofit of Existing Buildings

#### Figure 12

Level of Seismicity Definitions

#### Table 4-7. Checklists Required for a Tier 1 Screening

<table>
<thead>
<tr>
<th>Level of Seismicity</th>
<th>Required Checklists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>LS</td>
</tr>
<tr>
<td>Low</td>
<td>X</td>
</tr>
<tr>
<td>Moderate</td>
<td>X</td>
</tr>
<tr>
<td>High</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

*An X designates the checklist that must be completed for a Tier 1 screening as a function of the level of seismicity and level of performance.

**Source:** Table 4-7, page 67; ASCE Standard – ASCE/SEI 41-13: American Society of Civil Engineers – Seismic Evaluation and Retrofit of Existing Buildings
3. SEISMIC ASSESSMENT

Summary of ASCE 41-13 Tier 1 Evaluation

The Tier 1 screening phase identified numerous structural items as non-compliant. Non-compliant issues require further evaluation in order to determine their full impact on the seismic performance of the building, but these issues are a relatively good indicator of potential performance issues. A summary of some non-compliant issues is presented below organized by each checklist. Copies of the Tier 1 checklists and calculations are included in this report in Appendices A and B.

Life Safety Basic Configuration Checklist

- **Load Path** – A clear lateral load path to transfer seismic forces from the walls, into the roof and floor diaphragms, into the main lateral force resisting system, and then out into the foundations is required for compliance. The lateral force resisting system appears to be deficient. There is a lack of chords and/or dragstruts at the exterior of the building to resist moments caused by seismic forces. This may result in diaphragm failure during a seismic event. With the lateral force resisting system located at the stair and elevator core at the center of the building, there are large cantilevers of the flexible wood diaphragms of up to 65 feet. These were not been permitted even in the UBC 1982 that was used in the design of this building. These large cantilevers will cause extreme torsion at the diaphragm level during a seismic event which the wood diaphragms are not capable of sustaining. At the attached parking garage on the south side, there is no clear path to transfer shear from the hollow core planks to the concrete deck which will cause the parking garage to act independently of the rest of the city hall during an earthquake.

- **Mass** – There cannot be a change in effective mass of more than 50% from one story to the next. The mass of the parking garage at the first floor represents a mass greater than 50% of the second story. Because the first floor essentially functions as a podium and is surrounded on at least two sides by soil, this mass will not be considered a detriment to the seismic performance of the building.

- **Torsion** – For the building to comply for torsion, the center of mass and the center of rigidity at each floor cannot be more than 20% of the width of the building. Because of the cantilevered flexible diaphragm at all sides of the building, localized torsion will be experienced during a seismic event.

- **Liquefaction** – Liquefaction-susceptible soils cannot exist in the foundation soils at depths within 50ft under the building. In the absence of a site-specific geotechnical report, the Oregon Statewide Geohazards map prepared by DOGAMI is often used which indicates the station sits in an area with high liquefaction hazard. However, preliminary information from GeoDesign (preparing a site-specific geotechnical report for the future police station on the same site) indicates that liquefaction is not a hazard.

- **Ties Between Foundation Elements** – The foundation needs to have ties to resist seismic forces where footings are not restrained by
beams, slabs, or stiff soil. Since there are no ties from the footings to the slab or between spread footings, this building is not in compliance. In addition, since there is no geotechnical report, the soils on the site cannot be confirmed to be Class D.

**Life Safety Structural Checklist for Building Types C2A and RM1**

- **Complete Frames** – Where concrete walls provide both gravity support and lateral resistance, a concrete frame within the assembly must be specifically designed to provide vertical support in the event the wall is damaged by lateral forces. The concrete walls in this building may become damaged during a seismic event and must still be able to support gravity loads. The concrete cores in the City Hall building likely have not been adequately designed to carry both vertical and seismic loads.

- **Reinforcing Steel** – The spacing of reinforcing steel in reinforced masonry shear walls needs to be less than 48". The horizontal reinforcement in the reinforced masonry shear walls are spaced at 48”.

- **Shear Stress Check** – The ASCE 41 provides quick checks for the maximum shear stress in a shear wall. For a Tier 1 analysis, both the concrete and reinforced masonry shear walls failed the quick checks. Shear stress in the concrete walls was calculated to be greater than \(2\sqrt{f'c}\). Shear stress in the reinforced masonry wall was calculated to be greater than 70lb/in2.

- **Wood Ledgers** – The connections of wood ledgers to the concrete or masonry wall panels are not permitted to induce cross-grain bending or tension perpendicular to the grain in a wood member. This can cause non-ductile failure of the ledger. The wood ledgers at the shear wall cores induce cross-grain bending in the ledgers. See Figure 14.

- **Transfer to Shear Walls** – Diaphragms need to be connected to shear walls to transfer seismic forces, and the connections need to be strong enough to carry the load. The wood drag struts located at the corners of the shear wall cores were not found to have sufficient capacity to transfer seismic loads from the diaphragm to the shear walls. See Figure 15.

- **Coupling Beams** – Coupling beams connect two separate wall panels across a means of egress. They drag force from one wall to another, so they do not act independently during a seismic event. Shear stirrups are required in coupling beams above a means of egress. Since the plans do not show the necessary stirrups above means of egress, the concrete segments above means of egress are determined to be deficient.

- **Confinement Reinforcement** – All boundary elements of shear walls need to be confined with spirals or ties. The confinement reinforcement is insufficiently spaced at distances greater than 8db (3” for #3 ties). The plans call out for 6 ties spaced at 4” top and bottom and ties at 8” to fill the rest of the wall weight.
3. SEISMIC ASSESSMENT

- **Openings at Shear Walls** – Large openings in the diaphragms at shear walls limit the capability to transfer seismic forces from the diaphragms to the shear walls. At the north shear wall core, there is both a mechanical shaft and elevator shaft directly adjacent to the shear wall. These openings occur throughout the whole length of the shear wall; therefore, this check item is noncompliant.

- **Plan Irregularities** – Diaphragms need to have tensile capacity to resist seismic forces at reentrant corners or other plan irregularities. The Lake Oswego City Hall has many instances of reentrant corners that do not have any sort of strapping or ties to transfer tension forces across the diaphragm. This will cause shear failures at the corners during a seismic event.

- **Cross Ties** – Cross ties are required to make diaphragm chords act together during a seismic event. In the east to west direction, there are steel beams that tie one end of the building to the other, but there are no diaphragm chords to capture forces. It is unknown whether the connections between the steel beams can transfer seismic forces from one side of the building to the other. In the north to south direction, there is no strapping detailed where the I-joists attach to the steel beams.

- **Diagonally Sheathed and Unblocked Diaphragms** – Diagonally sheathed and unblocked diaphragms cannot span more than 30 feet or have aspect ratios greater than 3 to 1. Since the diaphragms in the City Hall building are unblocked and span distances much greater than 30 feet, the diaphragms are noncompliant.

- **Stiffness of Wall Anchors** – Anchors that connect wood structural elements to structural walls need to be installed taut or stiff, so there is very little relative movement between the wall and the diaphragm. It is unknown whether the anchors throughout the building have been installed as such.

**Additional Concerns from Site Visit**

- EIFS is clearly failing throughout the exterior of the building. There is visible water damage in some areas. The staff commented that mold and moisture seepage were prevalent in the exterior walls. This water damage is beyond the scope of this report.

- Many wide flange beams in the basement level were rusted and corroded. See Figures 16 and 17. This can cause the connections to fail as they further deteriorate.

- Some concrete beams at the basement level have experienced cracking. See Figure 18.

- The shear wall cores have some cracks forming. See Figure 19. It is unclear if these cracks are superficial surface level cracks caused by the installation of stair anchors, or if they are the result of building movement. Building staff members indicated that these cracks have been present since the building opened.
4. RECOMMENDATIONS
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4. RECOMMENDATIONS

RETROFIT RECOMMENDATIONS

Prior to completing a full or partial seismic retrofit design, material testing of key structural elements would be recommended. While not explicitly required by ASCE 41-13 for a building with a Life Safety performance level, the benefits of such testing typically outweigh the costs.

The Tier 1 structural deficiencies listed above will require further evaluation (ASCE 41-13 Tier 2 or 3 analyses) for the design of the seismic retrofits listed below. For Lake Oswego City Hall to meet the Life Safety Performance Level, each of these items will need to be further evaluated and brought up to current code requirements. The following narrative describes the approximate scope of one possible upgrade scheme to address the identified deficiencies. While the scope of the retrofits is listed here, and plans showing the extents of the retrofits are provided in Appendix D, the associated details and narrative are addressed in more detail in a separate cost estimating package.

STRUCTURAL RETROFITS

1. Addition of a braced frame along gridline A (east wall of the building) continuing to a thickened shear wall below and new/expanded foundations at the parking level.

2. Addition of braced frames along gridline E (west wall of the building) continuing down to new foundations at the street level.

3. Addition of braced frames along gridlines 1 and 9 (north and south walls of the building) continuing to thickened retaining wall or braces and new/expanded foundations at the parking level.

4. Provide a new braced frame and foundations at the first level along gridline 9 to support the elevated parking deck.

5. Strengthening of the existing stair and elevator cores with the addition of shotcrete or FRP and anchors to the foundations.

6. Provision of new dragstruts in line with core walls along gridlines 3 and 7 and potential strengthening of those along gridlines D and F. These new steel dragstruts would replace existing wood dragstruts or include strengthening existing steel girders as required.

7. Provide positive connections at girder transitions capable of transferring seismic forces (as at grid intersections H2, H3, H5, H7, K2, K3, K7, 1C, 1G, 9E, 9I, etc.) at the roof and floor levels 2 and 3.

8. Provide continuous cross ties in the north-south direction between wood trusses across girders. This would require demolition and replacement of portions of the existing gypcrete and installation of straps at ~4’-0” O.C.
4. RECOMMENDATIONS

9. Strengthening of shearwall segments supporting the elevated parking deck with the addition of shotcrete

CONCLUSIONS

The ASCE 41 Tier 1 analysis and assessment of the building demonstrates that it has several significant seismic deficiencies which can be expected to result in very poor seismic performance. While it was found that the veneer weight of the building could be increased slightly without altering the seismic mass of the building so much that a full seismic upgrade would be required explicitly by code, the deficiencies of this building are such that even a small change in the mass of the building is likely to violate the spirit and intent of the building code provisions intended to allow modification of a building. In order to justify increasing the mass of the building with a veneer change, the building would likely need to be brought into compliance with the current building code. Compliance with the current building code would require a full seismic retrofit of both the local and global seismic deficiencies of the building’s lateral force resisting system. If such a retrofit were completed, the building would certainly improve its structural capabilities and performance and could be brought up to a Life Safety performance level.

In order to design such a retrofit, a complete Tier 3 analysis of the building and seismic force resisting system would need to be conducted to fully understand all the issues that would require repair or retrofit to bring the building into conformance with Life Safety performance level requirements. The complete analysis and design development for those repairs is an effort that is beyond the scope of this investigation. Depending on the results of this additional analysis/investigation, there may be changes to the list of repairs above.
A. VENEER ANALYSIS
## Load Takeoffs

### Roof Load Takeoff

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight (psf)</th>
<th>Area (sf)</th>
<th>Weight (k)</th>
</tr>
</thead>
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<tr>
<td><strong>DEAD LOADS (ROOF)</strong></td>
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<tr>
<td>Roofing (psf)</td>
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<tr>
<td>Sheathing (psf)</td>
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<tr>
<td>Ceiling (psf)</td>
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</tr>
<tr>
<td>Lights (psf)</td>
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</tr>
<tr>
<td>Mechanical (psf)</td>
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<tr>
<td>Miscellaneous (psf)</td>
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<tr>
<td>Misc. Wood (psf)</td>
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<tr>
<td>Steel Beams (psf)</td>
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<td>Joists (psf)</td>
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<tr>
<td>Concrete (psf)</td>
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<td>194</td>
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### 3rd Floor Load Takeoff

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<td></td>
<td></td>
</tr>
<tr>
<td>Sheathing (psf)</td>
<td>2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling (psf)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lights (psf)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous (psf)</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misc. Wood (psf)</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel Beams (psf)</td>
<td>3.4</td>
<td></td>
<td></td>
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<tr>
<td>Joists (psf)</td>
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<td></td>
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<tr>
<td><strong>TOTAL PSF:</strong></td>
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<td>13400</td>
<td>388.6</td>
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### WALL LOADS (ROOF)

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<thead>
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<th>Description</th>
<th>Weight (psf)</th>
<th>Area (sf)</th>
<th>Weight (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shearwall Core (3):</td>
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<td></td>
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</tr>
<tr>
<td>8&quot; CMU Grout @ Reinf. (psf)</td>
<td>51</td>
<td></td>
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<tr>
<td>Tributary wall height (ft)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Length of wall (ft)</td>
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<td></td>
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<tr>
<td><strong>WEIGHT (k):</strong></td>
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### WALL LOADS (THIRD)

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<th>Area (sf)</th>
<th>Weight (k)</th>
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</thead>
<tbody>
<tr>
<td>Shearwall Core (3):</td>
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<td></td>
</tr>
<tr>
<td>8&quot; CMU Grout @ Reinf. (psf)</td>
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<td></td>
<td></td>
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<tr>
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<td>Length of wall (ft)</td>
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<td></td>
<td></td>
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<tr>
<td><strong>WEIGHT (k):</strong></td>
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### Exterior:

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<th>Weight (psf)</th>
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<th>Weight (k)</th>
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</thead>
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<tr>
<td>6&quot; Steel studs 43 mil (psf)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Gypsum (psf)</td>
<td>4</td>
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<tr>
<td>EIFS (psf)</td>
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<tr>
<td>Insulation (psf)</td>
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<td><strong>WALL WEIGHT (psf):</strong></td>
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<td>Tributary wall height (ft)</td>
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<td></td>
<td></td>
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<td>Length of wall (ft)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>WEIGHT (k):</strong></td>
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</table>
## Load Takeoffs

### 2nd Floor Load Takeoff

**DEAD LOADS (SECOND)**

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<tr>
<th>Material</th>
<th>PSF (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2&quot; Gypcrete</td>
<td>13</td>
</tr>
<tr>
<td>Sheathing</td>
<td>2.4</td>
</tr>
<tr>
<td>Ceiling</td>
<td>3</td>
</tr>
<tr>
<td>Lights</td>
<td>1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1.5</td>
</tr>
<tr>
<td>Misc. Wood</td>
<td>1.5</td>
</tr>
<tr>
<td>Steel Beams</td>
<td>3.4</td>
</tr>
<tr>
<td>Joists</td>
<td>3.2</td>
</tr>
</tbody>
</table>

**TOTAL PSF:** 29.0

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>Weight (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13400</td>
<td>388.6</td>
</tr>
</tbody>
</table>

**WALL LOADS (SECOND)**

Shearwall Core (3):

<table>
<thead>
<tr>
<th>Material</th>
<th>PSF (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot; CMU Grout @ Reinf.</td>
<td>51</td>
</tr>
<tr>
<td>Tributary wall height (ft)</td>
<td>6</td>
</tr>
<tr>
<td>Length of wall (ft)</td>
<td>52</td>
</tr>
<tr>
<td>8&quot; Concrete</td>
<td>100</td>
</tr>
<tr>
<td>Tributary wall height (ft)</td>
<td>7.5</td>
</tr>
<tr>
<td>Length of wall (ft)</td>
<td>52</td>
</tr>
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</table>

**WEIGHT (k):** 164.74

Exterior:

<table>
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<tr>
<th>Material</th>
<th>PSF (psf)</th>
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<tr>
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<tr>
<td>Gypsum</td>
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<tr>
<td>EIFS</td>
<td>1.5</td>
</tr>
<tr>
<td>Insulation</td>
<td>1</td>
</tr>
</tbody>
</table>

**WALL WEIGHT (psf): 8.33**

| Tributary wall height (ft)      | 13.5      |
| Length of wall (ft)             | 504       |

**WEIGHT (k):** 57
# Load Takeoffs

## 1st Floor Load Takeoff

**DEAD LOADS (FIRST)**
- Floor and decking (psf): 38.2
- Ceiling (psf): 3
- Lights (psf): 1
- Miscellaneous (psf): 1.5
- Misc. Wood (psf): 1.5
- Steel Beams (psf): 7.1

**TOTAL PSF:** 52.3

**PARKING LOT (FIRST)**
- 10" Hollowcore (psf): 67
- Flooring (psf): 31
- Miscellaneous (psf): 1.5
- Concrete Beams (psf): 10

**TOTAL PSF:** 109.5

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>WEIGHT (k):</th>
</tr>
</thead>
<tbody>
<tr>
<td>11900</td>
<td>622.37</td>
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</table>

**WALL LOADS (FIRST)**

**Shearwall Core (3):**
- 8" Concrete (psf): 100
- Tributary wall height (ft): 15
- Length of wall (ft): 52

**WEIGHT (k):** 234

**Basement Walls:**
- 8" Concrete (psf): 100
- Tributary wall height (ft): 7.5
- Length of wall (ft): 320

**WEIGHT (k):** 240

**Exterior:**
- 6" Steel studs 43 mil (psf): 1.83
- Gypsum (psf): 4
- EIFS (psf): 1.5
- Insulation (psf): 1

**WALL WEIGHT (psf):** 8.33

**WEIGHT (k):** 27.80

**PARKING LOT WALLS (FIRST)**
- 8" CMU Full Grout (psf): 81
- Tributary wall height (ft): 6
- Length of wall (ft): 263

**WEIGHT (k):** 127.82

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>WEIGHT (k):</th>
</tr>
</thead>
<tbody>
<tr>
<td>10000</td>
<td>1095</td>
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</table>

**8" Concrete (psf):**
- Tributary wall height (ft): 7.5
- Length of wall (ft): 402

**WEIGHT (k):** 301.5
**A. VENEER ANALYSIS**

### Distribution of Seismic Forces

**With Podium Included**

<table>
<thead>
<tr>
<th>BASE SHEAR</th>
<th>(12.8.1)</th>
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<tbody>
<tr>
<td>I</td>
<td>1.0</td>
</tr>
<tr>
<td>ρ</td>
<td>1.3</td>
</tr>
<tr>
<td>R</td>
<td>2.0</td>
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</table>

- Importance factor
- Redundancy factor
- Ordinary Reinforced Masonry Shearwall

<table>
<thead>
<tr>
<th>ρ *I/R</th>
<th>0.650</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_Ds</td>
<td>0.659 g</td>
</tr>
<tr>
<td>Cs</td>
<td>0.330</td>
</tr>
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</table>

**REDUNDANCY FACTOR NOT INCLUDED!!!**

<table>
<thead>
<tr>
<th>W</th>
<th>4058 k</th>
</tr>
</thead>
<tbody>
<tr>
<td>V, ew</td>
<td>1337 k</td>
</tr>
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</table>

**Vertical Distribution of Seismic Forces**

(12.8.3)

<table>
<thead>
<tr>
<th>Level</th>
<th>SDL (psf)</th>
<th>Area (ft²)</th>
<th>ht (ft)</th>
<th>w_x,fr (k)</th>
<th>w_x,wall (k)</th>
<th>w_x,total (k)</th>
<th>w_x*ht (k-ft)</th>
<th>C_x (%)</th>
<th>F_x (k)</th>
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</thead>
<tbody>
<tr>
<td>Upper 3rd/Roof</td>
<td>16.7</td>
<td>11600</td>
<td>54</td>
<td>194</td>
<td>72</td>
<td>265</td>
<td>14337</td>
<td>15.1%</td>
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<td>3rd Floor</td>
<td>29</td>
<td>13400</td>
<td>42</td>
<td>389</td>
<td>146</td>
<td>534</td>
<td>22447</td>
<td>23.7%</td>
<td>317</td>
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<tr>
<td>2nd Floor</td>
<td>29</td>
<td>13400</td>
<td>30</td>
<td>389</td>
<td>221</td>
<td>610</td>
<td>18300</td>
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<tr>
<td>1st Floor</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>1717</td>
<td>931</td>
<td>2648</td>
<td>39727</td>
<td>41.9%</td>
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<tr>
<td><strong>TOTAL</strong></td>
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<td><strong>2688</strong></td>
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<td><strong>4058</strong></td>
<td><strong>94812</strong></td>
<td><strong>100%</strong></td>
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**Diaphragm Design (Inertial) Forces (omit ρ)**

(12.10.1)

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<th>F_x (k)</th>
<th>ΣF_r (k)</th>
<th>F_x_min (k)</th>
<th>F_x_max (k)</th>
<th>F_p (k)</th>
<th>F_x design (k)</th>
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<td>265</td>
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<td>202</td>
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</table>
**NEW WALL LOADS (Total Wall Weight):**

<table>
<thead>
<tr>
<th>Level</th>
<th>Brick Veneer</th>
<th>W&lt;sub&gt;new&lt;/sub&gt;</th>
<th>V&lt;sub&gt;new&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3rd/Rooft</td>
<td>17 psf</td>
<td>4224 k</td>
<td>1392 k</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>17 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd Floor</td>
<td>17 psf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Floor</td>
<td>17 psf</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*NEW WALL LOADS (Total Wall Weight):*

Upper 3rd/Rooft:
- Brick Veneer: 17 psf

3rd Floor:
- Brick Veneer: 17 psf

2nd Floor:
- Brick Veneer: 17 psf

1st Floor:
- Brick Veneer: 17 psf

<table>
<thead>
<tr>
<th>Level</th>
<th>W&lt;sub&gt;x_wall new&lt;/sub&gt;</th>
<th>W&lt;sub&gt;x_total new&lt;/sub&gt;</th>
<th>W&lt;sub&gt;x_new*ht&lt;/sub&gt;</th>
<th>C&lt;sub&gt;x_new&lt;/sub&gt;</th>
<th>F&lt;sub&gt;x_new&lt;/sub&gt;</th>
<th>Weight Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3rd/Rooft</td>
<td>97</td>
<td>291</td>
<td>15688</td>
<td>15.6%</td>
<td>217</td>
<td>9.4%</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>198</td>
<td>587</td>
<td>2648</td>
<td>24.5%</td>
<td>341</td>
<td>9.8%</td>
</tr>
<tr>
<td>2nd Floor</td>
<td>280</td>
<td>669</td>
<td>20070</td>
<td>20.0%</td>
<td>278</td>
<td>9.7%</td>
</tr>
<tr>
<td>1st Floor</td>
<td>960</td>
<td>2677</td>
<td>40161</td>
<td>39.9%</td>
<td>556</td>
<td>1.1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1536</td>
<td>4224</td>
<td>100569</td>
<td>100%</td>
<td>1392</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

**Force base shear (Cs*W):**

(12.8-2)

<table>
<thead>
<tr>
<th>Level</th>
<th>W&lt;sub&gt;x_total new&lt;/sub&gt;</th>
<th>F&lt;sub&gt;x_new&lt;/sub&gt;</th>
<th>F&lt;sub&gt;x_min&lt;/sub&gt;</th>
<th>F&lt;sub&gt;x_max new&lt;/sub&gt;</th>
<th>F&lt;sub&gt;px new&lt;/sub&gt;</th>
<th>F&lt;sub&gt;x design&lt;/sub&gt;</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3rd/Rooft</td>
<td>291</td>
<td>217</td>
<td>38</td>
<td>76</td>
<td>217</td>
<td>217</td>
<td>7.4%</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>587</td>
<td>341</td>
<td>558</td>
<td>153</td>
<td>373</td>
<td>341</td>
<td>7.7%</td>
</tr>
<tr>
<td>2nd Floor</td>
<td>669</td>
<td>278</td>
<td>836</td>
<td>174</td>
<td>362</td>
<td>278</td>
<td>7.6%</td>
</tr>
<tr>
<td>1st Floor</td>
<td>2677</td>
<td>556</td>
<td>348</td>
<td>696</td>
<td>882</td>
<td>696</td>
<td>1.1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4224</td>
<td>1392</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A. VENEER ANALYSIS

Distribution of Seismic Forces  
ASCE 7-10, Ch. 12

With Podium Excluded

BASE SHEAR (12.8.1)

<table>
<thead>
<tr>
<th>Importance factor</th>
<th>Redundancy factor</th>
<th>Ordinary Reinforced Masonry Shearwall</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I )</td>
<td>( \rho )</td>
<td>( R )</td>
</tr>
<tr>
<td>1.0</td>
<td>1.3</td>
<td>2.0</td>
</tr>
</tbody>
</table>

\( \rho I/R \) 0.650

\( S_{DS} \) 0.659 g

\( C_s \) 0.330

\( W \) 1410 k

\( V, \text{ew} \) 465 k

REDUNDANCY FACTOR NOT INCLUDED!!!

Vertical Distribution of Seismic Forces (12.8.3)

<table>
<thead>
<tr>
<th>Level</th>
<th>SDL (psf)</th>
<th>Area (ft²)</th>
<th>ht (ft)</th>
<th>( w_k_{fr} ) (k)</th>
<th>( w_k_{wall} ) (k)</th>
<th>( w_k_{total} ) (k)</th>
<th>( w_k*ht ) (k-ft)</th>
<th>( C_s ) (%)</th>
<th>( F_x ) (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3rd/Roof</td>
<td>16.7</td>
<td>11600</td>
<td>39</td>
<td>194</td>
<td>72</td>
<td>265</td>
<td>10354</td>
<td>30.5%</td>
<td>142</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>29</td>
<td>13400</td>
<td>27</td>
<td>389</td>
<td>146</td>
<td>534</td>
<td>14430</td>
<td>42.5%</td>
<td>198</td>
</tr>
<tr>
<td>2nd Floor</td>
<td>29</td>
<td>13400</td>
<td>15</td>
<td>389</td>
<td>221</td>
<td>610</td>
<td>9150</td>
<td>27.0%</td>
<td>125</td>
</tr>
<tr>
<td>TOTAL</td>
<td>38400</td>
<td>971</td>
<td>439</td>
<td>1410</td>
<td>33935</td>
<td>100%</td>
<td>465</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diaphragm Design (Inertial) Forces (omit \( \rho \)) (12.10.1)

<table>
<thead>
<tr>
<th>Level</th>
<th>( w_x_{total} ) (k)</th>
<th>( \sum w_i ) (k)</th>
<th>( F_x ) (k)</th>
<th>( \Sigma F_i ) (k)</th>
<th>( F_{x\min} ) (k)</th>
<th>( F_{x\max} ) (k)</th>
<th>( F_{px} ) (k)</th>
<th>( F_{x\design} ) (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3rd/Roof</td>
<td>265</td>
<td>265</td>
<td>142</td>
<td>142</td>
<td>35</td>
<td>69</td>
<td>142</td>
<td>142</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>534</td>
<td>800</td>
<td>198</td>
<td>339</td>
<td>69</td>
<td>139</td>
<td>227</td>
<td>198</td>
</tr>
<tr>
<td>2nd Floor</td>
<td>610</td>
<td>1410</td>
<td>125</td>
<td>465</td>
<td>79</td>
<td>159</td>
<td>201</td>
<td>159</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1410</td>
<td>465</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### NEW WALL LOADS (Total Wall Weight):

#### Upper 3rd/Roof:
- Brick Veneer: 17 psf

#### 3rd Floor
- Brick Veneer: 17 psf

#### 2nd Floor
- Brick Veneer: 17 psf

#### 1st Floor
- Brick Veneer: 17 psf

<table>
<thead>
<tr>
<th>Level</th>
<th>W&lt;sub&gt;x&lt;/sub&gt;_wall new (k)</th>
<th>W&lt;sub&gt;x&lt;/sub&gt;_total new (k)</th>
<th>W&lt;sub&gt;x&lt;/sub&gt;_total new*ht (k-ft)</th>
<th>C&lt;sub&gt;v&lt;/sub&gt; new (%)</th>
<th>F&lt;sub&gt;x&lt;/sub&gt; new (k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3rd/Roof</td>
<td>97</td>
<td>291</td>
<td>11330</td>
<td>30.4%</td>
<td>155</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>198</td>
<td>587</td>
<td>15846</td>
<td>42.6%</td>
<td>217</td>
</tr>
<tr>
<td>2nd Floor</td>
<td>280</td>
<td>669</td>
<td>10035</td>
<td>27.0%</td>
<td>137</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>575</td>
<td>1546</td>
<td>37211</td>
<td>100%</td>
<td>510</td>
</tr>
</tbody>
</table>

#### Force base shear (C<sub>s</sub>*W) (12.8-2):
- Upper 3rd/Roof: 155 k
- 3rd Floor: 217 k
- 2nd Floor: 174 k
- **TOTAL**: 510 k

#### Level Weight Change (%):
- Upper 3rd/Roof: 9.4%
- 3rd Floor: 9.8%
- 2nd Floor: 9.7%
- **TOTAL**: 9.7%

---

#### A. VENEER ANALYSIS

| Level          | W<sub>x</sub>_total new new (k) | Σw<sub>i</sub> (k) | F<sub>x</sub> new (k) | ΣF<sub>i</sub> (k) | F<sub>x</sub> min new (k) | F<sub>x</sub> max new (k) | F<sub>p</sub>x new (k) | F<sub>x</sub> design (k) | Change (%)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper 3rd/Roof</td>
<td>291</td>
<td>291</td>
<td>155</td>
<td>155</td>
<td>38</td>
<td>76</td>
<td>155</td>
<td>155</td>
<td>9.4%</td>
</tr>
<tr>
<td>3rd Floor</td>
<td>587</td>
<td>877</td>
<td>217</td>
<td>372</td>
<td>76</td>
<td>153</td>
<td>249</td>
<td>217</td>
<td>9.8%</td>
</tr>
<tr>
<td>2nd Floor</td>
<td>669</td>
<td>1546</td>
<td>137</td>
<td>510</td>
<td>87</td>
<td>174</td>
<td>220</td>
<td>174</td>
<td>9.7%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1546</td>
<td>510</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Seismic Assessment
2160377.00

A-7
B. ASCE 41-13 CHECKLISTS
Tier 1: Screening Phase

**Required Information:**
- Level of Performance
- Level of Seismicity
- General Bldg. Description

**FIG. 4-1. Tier 1 Evaluation Process**

- **Benchmark Building?**
  - yes
  - Selection of Checklists
    - Sections 4.3
  - no
  - Sections 4.4

- **Very Low Level of Seismicity & Life-Safety Level of Performance?**
  - yes
    - Complete the Level of Very Low Seismicity Checklist
    - Sections 16.1.1
  - no
    - Complete the Basic Configuration Checklist
      - QUICK CHECKS
      - Sections 16.1

- **Very Low Seismicity (LS/IO) or Low, Moderate, or High Seismicity (LS/IO)?**
  - yes
    - Complete the Building System Structural Checklist
      - QUICK CHECKS
      - Sections 16.2 – 16.16
  - no
    - Complete the Nonstructural Checklist
      - Sections 16.17

- Summarize Deficiencies

- Further Evaluation Required?
  - yes
  - Section 3.3
  - no

---

**Chapters 2 & 3**
### APPENDIX C
#### SUMMARY DATA SHEET

**BUILDING DATA**

<table>
<thead>
<tr>
<th>Building Name:</th>
<th>Lake Oswego City Hall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Address:</td>
<td>380 &quot;A&quot; Avenue Lake Oswego, Oregon 97034</td>
</tr>
<tr>
<td>Latitude:</td>
<td>45.419399</td>
</tr>
<tr>
<td>Longitude:</td>
<td>-122.667684</td>
</tr>
<tr>
<td>Year Built:</td>
<td>1986</td>
</tr>
<tr>
<td>Year(s) Remodeled:</td>
<td>-</td>
</tr>
<tr>
<td>Original Design Code:</td>
<td>UBC 1982</td>
</tr>
<tr>
<td>Area (sf):</td>
<td>34,000 (+21,000 parking)</td>
</tr>
<tr>
<td>Length (ft):</td>
<td>120</td>
</tr>
<tr>
<td>Width (ft):</td>
<td>120</td>
</tr>
<tr>
<td>No. of Stories:</td>
<td>3</td>
</tr>
</tbody>
</table>

**USE**

- ☒ Industrial  
- ☐ Office  
- ☐ Warehouse  
- ☐ Hospital  
- ☐ Residential  
- ☐ Educational  
- ☐ Other: ____________

**CONSTRUCTION DATA**

- **Gravity Load Structural System:** Steel beams and columns with TJLX and TJI joists
- **Exterior Transverse Walls:** Non-structural metal studs with EIFS exterior
- **Exterior Longitudinal Walls:** Non-structural metal studs with EIFS exterior
- **Roof Materials/Framing:** 3/4" tongue and groove plywood decking with built up roof
- **Intermediate Floors/Framing:** HSS columns, TJI's, TJLX, wood sheathing, 1 1/2" Gypcrete, and WF girders
- **Ground Floor:** WF and concrete beams, metal deck with concrete topping slab
- **Columns:** HSS steel
- **Foundation:** Spread ftgs, Grade bms
- **General Condition of Structure:** Poor. Exterior cladding is failing, noticeable beam damage at ground floor
- **Levels Below Grade:** Concrete columns, walls, beams, WF beams. Hollowcore planks at parking
- **Special Features and Comments:** Large cantilevers of flexible wood diaphragm

**LATERAL-FORCE-RESISTING SYSTEM**

- **System:**
  - Longitudinal: Load bearing shear walls (cores)
  - Transverse: Same

- **Vertical Elements:**
  - Longitudinal: CMU and Concrete shear walls
  - Transverse: Same

- **Diaphragms:**
  - Longitudinal: Wood sheathing
  - Transverse: Same

- **Connections:**
  - Longitudinal: Poor
  - Transverse: Same

**EVALUATION DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_{ni}$</td>
<td>0.659</td>
</tr>
<tr>
<td>$S_{oi}$</td>
<td>0.387</td>
</tr>
<tr>
<td>$S_o$</td>
<td>1.2</td>
</tr>
<tr>
<td>$S_x$</td>
<td>0.185</td>
</tr>
<tr>
<td>$T$</td>
<td>0.312</td>
</tr>
<tr>
<td>$S_a$</td>
<td>0.593</td>
</tr>
<tr>
<td>$C_nC_iC_j$</td>
<td>1.1</td>
</tr>
<tr>
<td>$V_n$</td>
<td>830k</td>
</tr>
<tr>
<td>$W$</td>
<td>1400k</td>
</tr>
</tbody>
</table>

**Building Classification:**

- Basic Configuration Checklist: ☒
- Building Type RM1,C2A Structural Checklist: ☒
- Nonstructural Component Checklist: ☐

**FURTHER EVALUATION REQUIREMENT:**

Seismic Evaluation and Retrofit of Existing Buildings

---

Lake Oswego City Hall

**January 27, 2017**

B-2
### 16.1.2 LS LIFE SAFETY BASIC CONFIGURATION CHECKLIST

#### Low Seismicity

**Building System**

**General**

- **LOAD PATH**: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)

- **ADJACENT BUILDINGS**: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement shall not apply for the following building types: W1, W1a, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)

- **MEZZANINES**: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)

**Building Configuration**

- **WEAK STORY**: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)

- **SOFT STORY**: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)

- **VERTICAL IRREGULARITIES**: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)

- **GEOMETRY**: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)

- **MASS**: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)

- **TORSION**: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)

**Moderate Seismicity**: Complete the Following Items in Addition to the Items for Low Seismicity.

**Geologic Site Hazards**

- **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 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: Sec. 5.4.3.1)

- **SLOPE FAILURE**: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: Sec. 5.4.3.1)

- **SURFACE FAULT RUPTURE**: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: Sec. 5.4.3.1)

**High Seismicity**: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.

**Foundation Configuration**

- **OVERTURNING**: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than 0.65. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)

- **TIES BETWEEN FOUNDATION ELEMENTS**: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)
### 16.10LS  LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES C2: CONCRETE SHEAR WALLS WITH STIFF DIAPHRAGMS AND C2A: CONCRETE SHEAR WALLS WITH FLEXIBLE DIAPHRAGMS

#### Low and Moderate Seismicity

**Seismic-Force-Resisting System**

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPLETE FRAMES</td>
<td>C NC N/A U</td>
<td>Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)</td>
</tr>
<tr>
<td>REDUNDANCY</td>
<td>C NC N/A U</td>
<td>The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)</td>
</tr>
<tr>
<td>SHEAR STRESS CHECK</td>
<td>C NC N/A U</td>
<td>The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.² or $2\sqrt{f_c}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)</td>
</tr>
<tr>
<td>REINFORCING STEEL</td>
<td>C NC N/A U</td>
<td>The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)</td>
</tr>
</tbody>
</table>

**Connections**

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS</td>
<td>C NC N/A U</td>
<td>Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)</td>
</tr>
<tr>
<td>TRANSFER TO SHEAR WALLS</td>
<td>C NC N/A U</td>
<td>Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)</td>
</tr>
<tr>
<td>FOUNDATION DOWELS</td>
<td>C NC N/A U</td>
<td>Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)</td>
</tr>
</tbody>
</table>

**Connections**

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS</td>
<td>C NC N/A U</td>
<td>Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)</td>
</tr>
<tr>
<td>TRANSFER TO SHEAR WALLS</td>
<td>C NC N/A U</td>
<td>Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)</td>
</tr>
<tr>
<td>FOUNDATION DOWELS</td>
<td>C NC N/A U</td>
<td>Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)</td>
</tr>
</tbody>
</table>

**High Seismicity: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.**

**Seismic-Force-Resisting System**

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFLECTION COMPATIBILITY</td>
<td>C NC N/A U</td>
<td>Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)</td>
</tr>
<tr>
<td>FLAT SLABS</td>
<td>C NC N/A U</td>
<td>Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)</td>
</tr>
<tr>
<td>COUPLING BEAMS</td>
<td>C NC N/A U</td>
<td>The stirrups in coupling beams over means of egress are spaced at or less than $d/2$ and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)</td>
</tr>
</tbody>
</table>

**Connections**

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPLIFT AT PILE CAPS</td>
<td>C NC N/A U</td>
<td>Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)</td>
</tr>
</tbody>
</table>

**Diaphragms (Flexible or Stiff)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIAPHRAGM CONTINUITY</td>
<td>C NC N/A U</td>
<td>The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)</td>
</tr>
<tr>
<td>OPENINGS AT SHEAR WALLS</td>
<td>C NC N/A U</td>
<td>Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)</td>
</tr>
</tbody>
</table>
### Flexible Diaphragms

<table>
<thead>
<tr>
<th>Code</th>
<th>Status</th>
<th>Description</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>NC</td>
<td>CROSS TIES: There are continuous cross ties between diaphragm chords.</td>
<td>(Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)</td>
</tr>
<tr>
<td>C</td>
<td>NC</td>
<td>STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered.</td>
<td>(Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)</td>
</tr>
<tr>
<td>C</td>
<td>NC</td>
<td>SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing.</td>
<td>(Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)</td>
</tr>
<tr>
<td>C</td>
<td>NC</td>
<td>DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1.</td>
<td>(Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)</td>
</tr>
<tr>
<td>C</td>
<td>NC</td>
<td>OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing.</td>
<td>(Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)</td>
</tr>
</tbody>
</table>
**16.15LS  LIFE SAFETY STRUCTURAL CHECKLIST FOR BUILDING TYPES RM1: REINFORCED MASONRY BEARING WALLS WITH FLEXIBLE DIAPHRAGMS AND RM2: REINFORCED MASONRY BEARING WALLS WITH STIFF DIAPHRAGMS**

**Low and Moderate Seismicity**

**Seismic-Force-Resisting System**

- **REDUNDANCY**: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)

- **SHEAR STRESS CHECK**: The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 70 lb/in.². (Commentary: Sec. A.3.2.4.1. Tier 2: Sec. 5.5.3.1.1)

- **REINFORCING STEEL**: The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls is greater than 0.002 of the wall with the minimum of 0.0007 in either of the two directions; the spacing of reinforcing steel is less than 48 in., and all vertical bars extend to the top of the walls. (Commentary: Sec. A.3.2.4.2. Tier 2: Sec. 5.5.3.1.3)

**Stiff Diaphragms**

- **TOPPING SLAB**: Precast concrete diaphragm elements are interconnected by a continuous reinforced concrete topping slab. (Commentary: Sec. A.4.5.1. Tier 2: Sec. 5.6.4)

**Connections**

- **WALL ANCHORAGE**: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)

- **WOOD LEDGERS**: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Commentary: Sec. A.5.1.2. Tier 2: Sec. 5.7.1.3)

- **TRANSFER TO SHEAR WALLS**: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)

- **TOPPING SLAB TO WALLS OR FRAMES**: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled for transfer of forces into the shear wall or frame elements. (Commentary: Sec. A.5.2.3. Tier 2: Sec. 5.7.2)

- **FOUNDATION DOWELS**: Wall reinforcement is doweled into the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)

- **GIRDER–COLUMN CONNECTION**: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)

**Flexible Diaphragms**

- **OPENINGS AT SHEAR WALLS**: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)

- **OPENINGS AT EXTERIOR MASONRY SHEAR WALLS**: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)

**High Seismicity**: Complete the Following Items in Addition to the Items for Low and Moderate Seismicity.

**Stiff Diaphragms**

- **OPENINGS AT SHEAR WALLS**: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)

- **OPENINGS AT EXTERIOR MASONRY SHEAR WALLS**: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)

**Flexible Diaphragms**

- **CROSS TIES**: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)

- **OPENINGS AT SHEAR WALLS**: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)

- **OPENINGS AT EXTERIOR MASONRY SHEAR WALLS**: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 8 ft long. (Commentary: Sec. A.4.1.6. Tier 2: Sec. 5.6.1.3)
C NC N/A U STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)

C NC N/A U SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)

C NC N/A U DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)

C NC N/A U OTHER DIAPHRAGMS: The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)

Connections

C NC N/A U STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (Commentary: Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2)
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C. ASCE 41-13 CALCULATIONS

Design Maps Summary Report

User-Specified Input

Report Title  Lake Oswego City Hall
Wed December 21, 2016 18:19:14 UTC

(which utilizes USGS hazard data available in 2008)

Site Coordinates  45.4194°N, 122.66768°W

Site Soil Classification  Site Class D – “Stiff Soil”

USGS-Provided Output

\[ s_{S_{a,20/50}} = 0.291 \text{ g} \]
\[ s_{S_{a,20/100}} = 0.109 \text{ g} \]
\[ s_{Xs,5%,BSE-1E} = 0.456 \text{ g} \]
\[ s_{Xs,5%,BSE-1E} = 0.259 \text{ g} \]

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.
Section 2.4.1 – General Procedure for Hazard Due to Ground Shaking

20%/50-year maximum direction spectral response acceleration for 0.2s and 1.0s periods, respectively:

From Section 2.4.1.4  \( S_{s,20/50} = 0.291 \text{ g} \)

From Section 2.4.1.4  \( S_{s,20/50} = 0.109 \text{ g} \)

Section 2.4.1.6 – Adjustment for Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class C, based on the site soil properties in accordance with Section 2.4.1.6.1.

<table>
<thead>
<tr>
<th>SITE CLASS</th>
<th>SOIL PROFILE NAME</th>
<th>Soil shear wave velocity, ( \bar{v}_s ) (ft/s)</th>
<th>Standard penetration resistance, ( N )</th>
<th>Soil undrained shear strength, ( S_u ) (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hard rock</td>
<td>( \bar{v}_s &gt; 5,000 )</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>B</td>
<td>Rock</td>
<td>( 2,500 &lt; \bar{v}_s \leq 5,000 )</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>C</td>
<td>Very dense soil and soft rock</td>
<td>( 1,200 &lt; \bar{v}_s \leq 2,500 )</td>
<td>( N &gt; 50 )</td>
<td>&gt;2,000 psf</td>
</tr>
<tr>
<td>D</td>
<td>Stiff soil profile</td>
<td>( 600 \leq \bar{v}_s &lt; 1,200 )</td>
<td>( 15 \leq N \leq 50 )</td>
<td>1,000 to 2,000 psf</td>
</tr>
<tr>
<td>E</td>
<td>Stiff soil profile</td>
<td>( \bar{v}_s &lt; 600 )</td>
<td>( N &lt; 15 )</td>
<td>&lt;1,000 psf</td>
</tr>
</tbody>
</table>

For SI: 1 ft/s = 0.3048 m/s 1 lb/ft² = 0.0479 kN/m²
Table 2–3. Values of $F_s$ as a Function of Site Class and Mapped Short-Period Spectral Response Acceleration $S_s$

<table>
<thead>
<tr>
<th>Site Class</th>
<th>Mapped Spectral Acceleration at Short-Period $S_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$S_s \leq 0.25$</td>
</tr>
<tr>
<td>A</td>
<td>0.8</td>
</tr>
<tr>
<td>B</td>
<td>1.0</td>
</tr>
<tr>
<td>C</td>
<td>1.2</td>
</tr>
<tr>
<td>D</td>
<td>1.6</td>
</tr>
<tr>
<td>E</td>
<td>2.5</td>
</tr>
<tr>
<td>F</td>
<td>Site-specific geotechnical and dynamic site response analyses shall be performed</td>
</tr>
</tbody>
</table>

Note: Use straight-line interpolation for intermediate values of $S_s$

For Site Class = C and $S_s = 0.291 \text{ g}$, $F_s = 1.200$

Table 2–4. Values of $F_s$ as a Function of Site Class and Mapped Spectral Response Acceleration at 1 s Period $S_1$

<table>
<thead>
<tr>
<th>Site Class</th>
<th>Mapped Spectral Acceleration at 1 s Period $S_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$S_1 \leq 0.10$</td>
</tr>
<tr>
<td>A</td>
<td>0.8</td>
</tr>
<tr>
<td>B</td>
<td>1.0</td>
</tr>
<tr>
<td>C</td>
<td>1.7</td>
</tr>
<tr>
<td>D</td>
<td>2.4</td>
</tr>
<tr>
<td>E</td>
<td>3.5</td>
</tr>
<tr>
<td>F</td>
<td>Site-specific geotechnical and dynamic site response analyses shall be performed</td>
</tr>
</tbody>
</table>

Note: Use straight-line interpolation for intermediate values of $S_1$

For Site Class = C and $S_1 = 0.109 \text{ g}$, $F_s = 1.691$
C. ASCE 41-13 CALCULATIONS

11/22/2016

Provided as a reference for Equation (2-4):

\[ F_a S_{S_{20/50}} = 1.200 \times 0.291 \text{ g} = 0.349 \text{ g} \]

Provided as a reference for Equation (2-5):

\[ F_v S_{1,20/50} = 1.691 \times 0.109 \text{ g} = 0.185 \text{ g} \]

Provided as a reference for Equation (2-4):

\[ S_{X5,BSE-1N} = \frac{3}{4} \times S_{X5,BSE-2N} = \frac{3}{4} \times F_a S_{S,BSE-2N} = 0.659 \text{ g} \]

Provided as a reference for Equation (2-5):

\[ S_{X1,BSE-1N} = \frac{3}{4} \times S_{X1,BSE-2N} = \frac{3}{4} \times F_v S_{1,BSE-2N} = 0.387 \text{ g} \]

Equation (2-4): \( S_{X5,BSE-1E} = \text{MIN}[F_a S_{S,20/50}, S_{X5,BSE-1N}] = \text{MIN}[0.349\text{g}, 0.659\text{g}] = 0.349\text{g} \)

Equation (2-5): \( S_{X1,BSE-1E} = \text{MIN}[F_v S_{S,20/50}, S_{X1,BSE-1N}] = \text{MIN}[0.185\text{g}, 0.387\text{g}] = 0.185\text{g} \)

Section 2.4.1.7.1 — General Horizontal Response Spectrum

![General Horizontal Response Spectrum](image)

\[ S_x = \begin{cases} 
0 < T < T_0: & S_{X5} \left( \frac{1}{T_0} \right)^3 \\
T_0 < T < T_S: & S_{X5} \left( \frac{1}{T_0} \right)^3 + 0.4 \\
T_S < T: & S_{X1} \left( \frac{1}{T_0} \right)^3 
\end{cases} \]

Lake Oswego City Hall
January 27, 2017

C-4
Section 2.4.1.7.2 — General Vertical Response Spectrum

The General Vertical Response Spectrum is determined by multiplying the General Horizontal Response Spectrum by $\frac{2}{3}$. 

$$2S_{\text{H}} / 3B_{\text{H}} = 0.233$$

$$2S_{\text{V}} / 3B_{\text{H}} = 0.123$$

$$0.8S_{\text{H}} / 3 = 0.093$$

Period, $T$ (sec)
C. ASCE 41-13 CALCULATIONS

ASCE 41-13 ANALYSIS FOR LO CITY HALL

ROOF WEIGHT

ROOFING: 1,078 ft² BUILT-UP ROOF
SHEETING: 2,444 ft² 3/4" Plywood Decking
CEILING: 4,916 ft² SUSPENDED ACOUSTIC CEILING
LIGHTS: 1,130 ft²
MECH.: 2,013 ft²
FINISH: 1,575 ft²
MISC. 1,374 ft²

TOTAL: 12,455 ft²

Walls:

24" TILCK @ 4.8" O.C.

Cement: (3,5" thick) 150 p.s.f. (9" @ 10' = 10 kips)

Concrete:

 Joan = (3.5"") @ (10.5") = 200 ft²

3.5" thick

Walls:

30" TILCK @ 24" O.C.

Coverage area: 2340 + 735 = 3075 ft²

4.25 lb/ft² 216 = 2115 ft²

30" TILCK (3.5"") = 1.53 k

14" TILCK @ 24" O.C.

Coverage area: 1080 ft²

8.16 lb/ft² = 66 ft²

14" TILCK @ 48" O.C.

Coverage area: 675 ft²

T11 Weight: 18,75 k

By: OQ5

Date: 1/12/15

Job #: 2640379.00

Mackenzie. Architecture - Interiors - Planning - Engineering

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Seattle, WA 206.749.9993

Lake Oswego City Hall

January 27, 2017

C-6
C. ASCE 41-13 CALCULATIONS

SECOND AND THIRD FLOOR WEIGHT

1 1/2" Gypsum: 15 psf
Sheathing: 2.4 psf
Ceiling: 8 psf
Linoleum: 1 psf
Misc. Sheet Metal: 1.5 psf
Misc. Wood: 1.5 psf
Steel Beams: 3.4 psf
3.2 psf (TIL\&10"0.C.
59 psf (13400 sf²) = 388,160 lbs

WALLS - 3rd

2.5" CMU Wall
Grounded @ Reinf. Con. Cell (2"0C.)
51 psf
51 psf (12 sf²) (2 (8 sf²) + 2 (18 sf²)) (3 courses) = 95,470 lbs

EXTENSION

6" Steel Stubs: 43 mil @ 1"0C.
1.43 psf
1.63 psf
STUDS: 1.05 psf + 1.5 psf + 1.5 psf = 50.48 K
3rd Weight Floor: 388,460 lbs
Walls: 95,470 lbs
50,380 lbs
534,450 lbs

2nd FLOOR CONC. CEIL.: 2.5" TILES
8" Conc. + CMU
150 psf (6.5") + (2.5") + (2.5") + (2.5") + (2.5") (3 courses) = 477 K
CMU 8" Adair @ Reinf. (2"0C.)
(5 psf) (6 sf²) (2.5") + (2.5") (3 courses) = 17,740 lbs
EXTENSION
6" Steel Stubs: 43 mil @ 1"0C.
1.83 psf + 4 psf + 1.5 psf + 1 psf (15.5 sf²) (504 sf²) = 56,150 lbs

By OGS
Date 1/22/14
2160377.00

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Seismic Assessment
2160377.00
C-7
C. ASCE 41-13 CALCULATIONS

FIRST FLOOR WEIGHT: A = 11,900 ft²

- Floor: 38.2 psf (2 1/2" concrete slab on furring)
- Decking: 24 psf (2" Dek)
- Ceiling: 3 psf (suspended acoustical ceiling)
- Windows: 1 psf
- Misc.: 1.5 psf
- Misc. Wood: 1.5 psf
- Steel Beams: 2.1 psf

\[-2.3 \text{ psf} \times 11,900 \text{ ft}^2 = 27,220.3 \text{ K}\]

WALLS:
(1) Core Walls (15 1/2 ft.):
8 ft. conc. wall
8 ft. conc. wall (15 1/2 ft.)
150 psf (8 1/2" (15 1/2 ft.)) (21 8 1/2" x 21 8 1/2") (3,000 lbs) = 234 K

EXTERNAL:
- Steel Studs: 4.3 lbs / ft. x 10 ft. = 43 lbs
- Soffit: 1.0 psf x 300 ft = 300 psf

\[1.0 \text{ psf} + 1.5 \text{ psf} + 1.5 \text{ psf} + 1.0 \text{ psf} (7.5 \text{ ft}) = 27.8 \text{ K}\]

Parking Lot:
- 10' x 10' Parking Lot:

\[109.5 \text{ psf} \times (10,000 \text{ ft}^2) = 1100 \text{ K}\]

Walls:
- 8" can pull out 1st floor:

\[(8 \text{ psf}) \times (10 \text{ ft}) \times (11 \text{ ft}) = 952.8 \text{ K}\]

BASEMENT WALLS:
- 8" conc.:

\[150 \text{ psf} (7.5 \text{ ft}) (210 \text{ ft}) + 115 \text{ ft}) = 452.25 \text{ K}\]

1ST FLOOR WEIGHT:
- Floor: 62 ft²
- Walls: 23.4 K
- 240 K
- 27.8 K

TOTAL: 2735.5 K

Date: January 27, 2017

By: C.O.T
ASCE TIER 1 ANALYSIS - WITH POSTULATED

PERIOD: \( T = \frac{C_p}{n} \) (ASCE 41-13)

\( h_n = 30 \text{ ft} \) TO ROOF LINE (NOT MEASURED)

\( B = 0.415 \)

\( C_p = 0.02 \)

\( T = 0.398 \) (\( 0.398^2 \))

SPECTRAL ACCELERATION

\( S_a \times \frac{K}{T} \) (ASCE 41-13)

\( S_{a1} = 0.185 \)

\( S_a = \frac{0.185}{0.398} = 0.465 \)

SEISMIC FORCE

\( V = C_s a \) (ASCE 41-13)

\( C_s = 1.0 \)

\( V = (1.0)(0.185)(0.465) = 189.5 \text{k} \)

STORY SHEAR FORCE

\( F_x = \frac{W_kh_k}{V_k} \) (ASCE 41-13)

ROOF: \( F_{roof} = \frac{W_{roof} h_{roof}}{V} = \frac{267.6 \times 5(94.6)}{94.6^2} = 2476.6 \times 5 = 74.7 \text{k} \)

2nd: \( F_3 = \frac{267.6 \times 5(94.6)}{94.6^2} = 449.5 \text{k} \)

2nd: \( F_2 = \frac{366.4 \times 5(94.6)}{94.6^2} = 366.4 \text{k} \)

1st: \( F_1 = \frac{1091.2 \times 5(94.6)}{94.6^2} = 808.8 \text{k} \)

\( V = \frac{275.3 \times 49.5}{94.6^2} = 724.8 \text{k} \)

\( V = 724.8 + 366.4 = 1091.2 \text{k} \)

\( V = 1091.2 + 808.8 = 1899.0 \text{k} \)
C. ASCE 41-13 CALCULATIONS

ASCE TIBER 1 ANALYSIS - 1.0 PONDIAH

\[ T = \frac{C h}{w} \] (ASCE 41 4.5)

\[ h = 39.5 \text{ ft} \]

\[ w = 0.25 \]

\[ C = 0.02 \]

\[ g = 0.02 \]

\[ T = 0.02 (39.5 \text{ ft})^{0.75} = 0.312 \]

SPECTRAL ACCELERATION

\[ S_x = \frac{S_x}{T} \] (ASCE 41 4.4)

\[ S_x = 0.185 \]

\[ T = 0.312 \]

\[ S_s = \frac{0.185}{0.312} = 0.593 \]

SEISMIC REDUCTION FACTOR

\[ V = C S_s W \] (ASCE 41 4.1)

\[ C = 1.0 \]

\[ V = 1.0 (0.593) (1000) = 830 \text{ K} \]

STUDY SHEAR FORCE

\[ F_x = \frac{W H V}{K} \]

\[ F_{roof} = \frac{W \times H \times V}{33510.9} \]

\[ = \frac{254.6 \text{ k} (39 \text{ ft}) (830 \text{ k})}{33510.9} = 244 \text{ k} \]

2nd: \[ F_2 = \frac{531.5 \text{ k} (23.5 \text{ ft}) (830 \text{ k})}{33510.9} = 358 \text{ k} \]

2nd: \[ F_2 = \frac{610 \text{ k} (15 \text{ ft}) (830 \text{ k})}{33510.9} = 227 \text{ k} \]

\[ V_j = \frac{n F_x}{K} \]

\[ V_{roof} = 244 \text{ k} \]

\[ V_2 = 244 + 358 = 602 \text{ k} \]

\[ V_2 = 602 - 227 = 375 \text{ k} \]
Localized Mass Locations - Center of Mass Calculation
C. ASCE 41-13 CALCULATIONS

CENTER OF MASS CALCULATION - 2nd and 3rd Floor

1. $m_1 = 29 \text{ psf} \times (40 \text{ ft})(65.6 \text{ ft}) = 114.1 \text{ kN}$
   \[ y_1 = 32.8 \text{ ft} \]

2. $m_2 = 29 \text{ psf} \times (39.5 \text{ ft})(15 \text{ ft}) = 18.6 \text{ kN}$
   \[ y_2 = 14.5 \text{ ft} \]

3. $m_3 = 29 \text{ psf} \times (10.5 \text{ ft})(30.5 \text{ ft}) = 782.3 \text{ kN}$
   \[ y_3 = 24.5 \text{ ft} \]

4. $m_4 = 29 \text{ psf} \times (35.5 \text{ ft})(60 \text{ ft}) = 61.8 \text{ kN}$
   \[ y_4 = 101.3 \text{ ft} \]

5. $m_5 = (10.6 \text{ psf})(18.3 \text{ ft})(60 \text{ ft}) = 19.5 \text{ kN} + 164.4 \text{ kN} \text{ (walls)}$
   \[ y_5 = 7.4 \text{ ft} \]

6. $m_6 = 29 \text{ psf} \times (15.5 \text{ ft})(30.5 \text{ ft}) = 13.1 \text{ kN}$
   \[ y_6 = 104 \text{ ft} \]

7. $m_7 = 29 \text{ psf} \times (10.5 \text{ ft})(30.5 \text{ ft}) = 52.2 \text{ kN}$
   \[ y_7 = 29.5 \text{ ft} \]

$\sum m_i = 511.2 \text{ kN}$

\[ \bar{y} = \frac{(114.1 \times 32.8) + 12.6(14) + 782.3(7.4) + 61.8(101.3) + 164.4(7.4) + 13.1(104) + 52.2(29)}{511.2} \]
\[ \bar{y} = 45.9 \text{ ft} \]

Center of rigidity is at 34 ft. Only separated by about 8 ft ≤ 20% building width.

By: DGS

Date __________________
Job #: ________________
Shi. __________________

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Lake Oswego City Hall
January 27, 2017

C-12
Seismic Assessment

C. ASCE 41-13 CALCULATIONS

Overturning - With Podium

Grade Behind Wall = 30 ft
Building HT = 50 ft

\[
\frac{20}{50} = 0.4 \times 50 = 20 \text{ ft}
\]

0.0 sq. = 0.0 \times (0.5 ft) = 0.05 \times 0.5 ft = 0.05 ft

Compliant
C. ASCE 41-13 CALCULATIONS

SIMPLE STRESS CHECK WITH PODIUM

CONCRETE = N to 5
\[
\frac{V_z}{V_s} = \frac{1}{N} \left( \frac{V_s}{M_N} \right)
\]

\[M_s = 2.0\]

8" THICK CONCRETE SHEET PILE WALL

\[\text{wall width} = 4.933 + \frac{7}{3} + 4.067 + 8.067 \times 1 + 4 \times 8.067 \times 1 = 41.4"\]

\[\frac{V_L}{V_s} = \frac{1}{2} \left( \frac{109.1 \times 1k}{47.5 \times 1m^2} \right) = 128.2 \frac{lb}{in^2}\]

\[2 \sqrt{c} = 2 \times 12300 = 109.5 \frac{lb}{in^2} < 128.2 \frac{lb}{in^2} \text{ NOT COMPLIANT}\]

\[V_{1, AV} = \frac{1}{M_s} \left( \frac{V_L}{A_W} \right) \quad M_s = 2.0 \quad \frac{lb}{in^2} > 1000\ psi\]

\[\text{wall height} = (8.067 + \frac{7}{3}) = 48.067 \times 584 in\]

\[A_W = 584 in \times (8 in) = 4672 in^2\]

\[V_{1, AV} = \frac{1}{2} \left( \frac{1894/1 k}{4672 in^2} \right) \left( \frac{1000 lb}{1 k} \right) = 202.8 \frac{lb}{in^2} < 24000 = 126.5 \frac{lb}{in^2} \text{ NOT COMPLIANT}\]

CONCRETE - E TO W

\[V_{2, AV} = \frac{1}{M_s} \left( \frac{V_L}{A_W} \right) \]

\[\text{wall height} = (18 + \frac{7}{3}) + 3.1 + 3.1 + 2 = 39.7" \times 119 in\]

\[A_W = 119 in \times (8 in) = 950 in^2\]

\[V_{2, AV} = \frac{1}{2} \left( \frac{109.1 \times 1k}{950 in^2} \right) \left( \frac{1000 lb}{1 k} \right) = 57.3 \frac{lb}{in^2} < 109.5 \frac{lb}{in^2} \text{ COMPLIANT}\]

\[V_{1, AV} = \frac{1}{M_s} \left( \frac{V_L}{A_W} \right) \]

\[\text{wall height} = (18 + \frac{7}{3}) + (10 + 7) + 2.5 + 3.1 + 2 + 5.7 + 2.5 = 95.7" \times 118 in\]

\[A_W = 118 in \times (8 in) = 946 in^2\]

\[V_{1, AV} = \frac{1}{2} \left( \frac{1894/1 k}{946 in^2} \right) \left( \frac{1000 lb}{1 k} \right) = 163.9 lb/in^2 < 126.5 lb/in^2 \text{ COMPLIANT}\]

Lake Oswego City Hall
January 27, 2017

C-14
C. ASCE 41-13 CALCULATIONS

Shear Stress Check: No Podium

Concrete - U to 2

\[ \frac{V_{20g}}{A_g} = \frac{1}{m_s} \left( \frac{V_2}{f_{lw}} \right) \]

Wall length = 4.33' + 13' + 8.06' + 9.06' = 40' - 8"

\[ A_{lw} = W_{\text{load}} \times (8'') = 3520 \text{ in}^2 \]

\[ V_{20g} = 1 \times 1 \left( \frac{8600}{3520} \right) = 117.9 \text{ psi} > 97.5 \text{ psi} \text{ Non-Compliant} \]
C. ASCE 41-13 CALCULATIONS

REINFORCING STEEL

VERT. # 6 @ 15' O.C.
LOR. # 5 @ 15' O.C.

SPACEING IS CLOSER THAN 15'  COMPLIANT

VERT.

AREA FOR 15" SECTION

A_C = 15" (8") = 120 in^2
A_S = 0.31 in^2

\[
\frac{A_c}{A_C} = \frac{0.31}{120} = 0.0026 > 0.0012 \quad \text{COMPLIANT}
\]

HOE:

AREA FOR 15" SECT HAN

A_C = 15" (8") = 120 in^2
A_S = 0.31 in^2

\[
\frac{A_c}{A_C} = \frac{0.31}{120} = 0.0026 > 0.0020 \quad \text{COMPLIANT}
\]

TRANSFER TO SIDE WALLS

DIMENSION: 11/4" CIPMATE OVER 1/4" FLATWOOD BEARING
Seismic Assessment

C. ASCE 41-13 CALCULATIONS

SHEAR STRESS CHECK - WITH PODIA

MASONRY

\[ V_m = \frac{1}{m_S} \left( \frac{V_{0se}}{A_W} \right) \]

8'' thick masonry shearwalls

\[ \text{Wall Length} = 4'' \cdot 38'' + 3'' \cdot 82'' + 4'' \cdot 76'' + 7'' + 0'' + 8'' = 419'' \]

\[ A_W = \frac{419''}{12} = 34.92 \text{ in}^2 \]

\[ V_{0se} = \frac{1}{2.0} \left( \frac{275.3 \text{k}}{419 \text{in}^2} \right) = 31.3 \text{ psi} \leq 70 \text{ psi} \quad \text{compliant} \]

\[ V_3 \leq \frac{1}{m_S} \left( \frac{V_3}{A_W} \right) \]

\[ \text{Wall Length} = 18'' \cdot 3'' + 18'' \cdot 3'' + 5'' \cdot 2'' + 4'' \cdot 2'' = 378'' \]

\[ A_W = 11.87 \text{ in}^2 \]

\[ V_{0se} = \frac{1}{2.0} \left( \frac{275.3 \text{k}}{419 \text{in}^2} \right) = 14.5 \text{ psi} \leq 70 \text{ psi} \quad \text{compliant} \]

\[ V_3 \leq \frac{1}{m_S} \left( \frac{V_3}{A_W} \right) \]

\[ \text{Wall Length} = 18'' \cdot 3'' + 18'' \cdot 3'' + 5'' \cdot 2'' + 4'' \cdot 2'' = 378'' \]

\[ A_W = 11.87 \text{ in}^2 \]

\[ V_3 \leq \frac{1}{2.0} \left( \frac{275.3 \text{k}}{419 \text{in}^2} \right) = 31.3 \text{ psi} \leq 70 \text{ psi} \quad \text{compliant} \]
C. ASCE 41-13 CALCULATIONS

SHEAR STRESS CHECK - NO PODIUM

MASONRY 1/2 TO 3/4 "m = 2.10

\[ \frac{V_{\text{front}}}{A_{\text{f}}} = \frac{1}{m_c} \left( \frac{V_{\text{front}}}{b_w} \right) \]

8" THICK MASONRY

\[ A_{\text{W}} = 532 \text{ in} \]

\[ V_{\text{front}} = \frac{1}{20} \left( \frac{214 \text{ kips}}{425 \text{ in}} \right) = 28.9 \text{ psi} < 40 \text{ psi, COMPLIANT} \]

\[ V_3 = \frac{1}{m_c} \left( \frac{V_3}{b_w} \right) \]

\[ V_3 = \frac{1}{20} \left( \frac{6.4 \text{ kips}}{382 \text{ in}} \right) = 79.0 \text{ psi} > 70 \text{ psi, NOT COMPLIANT} \]

Lake Oswego City Hall

January 27, 2017

C-18
C. ASCE 41-13 CALCULATIONS

**D R A N G S T R U T C A P A B I L I T I E S**

**1.4 D R A N G S T R U T 3 0 5 4**

\[ b = 3.5 \text{ in} \]
\[ d = 3.5 \text{ in} \]
\[ \frac{\ell_0}{d} = \frac{36(12)}{3.5} = 102.86 \]

**COMPRESSIONS:**

**N O S 3.7.1.4** S U N D O W N I N G RATIO \( \ell_0/d \) S H A L L N O T E X C E E D \( 5.0 \) **NO GOOD**

**TENSION:** \[ T' = F'L A \]
\[ A = (3.5" - 1") (3.5") = 8.45 \text{ in}^2 \]
\[ F'(L) = F_e c_0 c_1 c_2 c_3 c_4 = 575 \text{ psi} (1.6)(1.5) = 1380 \text{ psi} \]
\[ T' = F'L A = 1380 \text{ psi} (8.45 \text{ in}^2) = 12 \text{ k} \]

**3.5" x 10" G L B. D R A N G S T R U T 3 0 5 4**

\[ b = 3.5 \text{ in} \]
\[ d = 10 \text{ in} \]
\[ \frac{\ell_0}{d} = \frac{30(12)}{10} = 3.6 \]

**COMPRESSIONS:**

**N O S 3.7.1.4** S U N D O W N I N G RATIO \( \ell_0/d \) S H A L L N O T E X C E E D \( 5.0 \) **NO GOOD**

**TENSION:** \[ T' = F'L A \]
\[ F'(L) = F_e c_0 = 1100 \text{ psi} \]
\[ A = (3.5") (6.1") = 17.5 \text{ in}^2 \]
\[ T' = F'L A = 1700 \text{ psi} (17.5 \text{ in}^2) = 30.8 \text{ k} \]
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Lake Oswego City Hall
January 27, 2017

Seismic Assessment

2160377.00

Revit Project: 377-LOCH-L.rvt

Sheet Title: D. RETROFIT FLOOR PLANS

Sheet Title: BASEMENT FLOOR PLAN

Project: City Hall Existing Conditions Assessment

Revision Schedule

3/32" = 1'-0"

Revision Delta Issue Date

A2.0

City Hall Existing Conditions Assessment

Add to existing foundation

Strengthen wall/columns w/ shotcrete and reinforcing per sketches S1 and B6.

Dowel to enlarged footing per sketch S2

Enlarge foundations as required w/ reinforcing and concrete per sketch F1

New continuous foundation

New braced frame at transition per sketch B2

Improve existing concrete shearwalls w/ concrete and reinforcing per sketch S1.

Dowel to enlarged footing per sketch S2

Add to existing foundation per sketch F1

Strengthen wall/columns w/ shotcrete and reinforcing per sketches S1 and B5.

Dowel to enlarged footing per sketch S2

Strengthen column w/ 4" add'l shotcrete and reinforcing similar to sketch B6.

Enlarge foundations per sketch F1

Improve existing concrete shearwalls w/ concrete and reinforcing per sketch S1.

Dowel to enlarged footing per sketch S2

Improve existing concrete shearwalls w/ concrete and reinforcing per sketch S1.

Dowel to enlarged footing per S2.

Add to existing foundation per sketch F1

Strengthen wall/columns w/ shotcrete and reinforcing per sketches S1 and B5.

Dowel to enlarged footing per sketch S2

Improve existing concrete shearwalls w/ concrete and reinforcing per sketch S1.

Dowel to enlarged footing per S2.

Add to existing foundation per sketch F1

Strengthen column w/ 4" add'l shotcrete and reinforcing similar to sketch B6.

Enlarge foundations per sketch F1
Lake Oswego City Hall
January 27, 2017

City Hall Existing Conditions Assessment
Lake Oswego, OR 97034

Seismic Assessment
Seismic Assessment

Strengthen walls with shotcrete/reinforcing per sketch S1
New braced frame to strengthen shearwall per sketch B1

Improve steel connection as chord/tie/dragstrut per sketch V2, SIM

Replace/strengthen beam as new dragstrut from brace above to brace below per sketch B2
New steel braced frame; pipe, X-configuration per sketch B2

New foundation
New concrete dragstrut dowelled to underside of deck per S4

New braced frame, beams, and column per sketch B4
New braced frames, columns, and beams per sketch B3

3/32" = 1'-0"
Lake Oswego City Hall
January 27, 2017

Seismic Assessment
2160377.00

City Hall Existing Conditions Assessment
Lake Oswego, OR 97034

Third Floor Plan

Drawing:
- New braced frames, columns, and beams per sketch B3
- New steel braced frame per sketch B1
- Improve steel connection as chord/tie/dragstrut per sketch V2, typ.
- New braced frame and column per sketch B1
- Replace existing 4x4 dragstrut w/ HSS per sketch V3
- Replace existing GLB dragstrut w/ HSS per sketch V3
- Strengthen walls w/ shotcrete/reinforcing per sketch S1

Notes:
- Strap between wood joists across girder per sketch V1, typ.

Sheet Title: Third Floor Plan

Checked By:

Drawn By:

City of Lake Oswego

Strap between wood joists across girder per sketch V1, typ.

New braced frame, beams, and column per sketch B4

New steel braced frame per sketch B1

Improve steel connection as chord/tie/dragstrut per sketch V2, typ.

New braced frame and column per sketch B1

Replace existing 4x4 dragstrut w/ HSS per sketch V3

Replace existing GLB dragstrut w/ HSS per sketch V3

Strengthen walls w/ shotcrete/reinforcing per sketch S1

New braced frames, columns, and beams per sketch B3

© Client

Date: 3/32" = 1'-0"
# Summary of Previous Seismic and Envelope Evaluation Reports

## January 27, 2017

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<th>SEISMIC</th>
<th>STRUCTURAL IMPLICATIONS OF ENVELOPE</th>
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<th>ADA</th>
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**LEGEND**

- General Review and Visual Observation:  
- Detailed Analysis:  
- Destructive Testing:  
- Remediation Recommendations:  
- Cost Estimate for Repair:  

*Mackenzie is aware these reports exist, as they were referenced in other reports. However, Mackenzie has not received nor reviewed these reports; information contained in reports is unknown.

**In Progress
LAKE OSWEGO CITY HALL – ENVELOPE REPLACEMENT NARRATIVE

To
City of Lake Oswego

For
Lake Oswego City Hall

Submitted
January 23, 2017

Project Number
2160377.00
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II. Envelope Replacement Narrative .............................................................................. 2
    Finish Impacts include: ............................................................................................... 2
    Structural Impacts include: ....................................................................................... 2
    Miscellaneous ........................................................................................................... 3

ATTACHMENTS

I. INTRODUCTION

The purpose of this narrative is to describe the architectural and structural impacts for replacing the Lake Oswego City Hall Building envelope, with materials to match existing. This narrative assumes that there are no impacts to the floor plan layouts and that additional voluntary upgrades will be priced under a separate cover.
II. ENVELOPE REPLACEMENT NARRATIVE

See Attached drawings for additional information.

Finish Impacts include:

EIFS Cladding

Remove and replace all EIFS cladding, where occurs. See attached plans and elevations, Scope of Repair Item 1, for more information.

Tile Cladding

Remove and replace all tile cladding, where occurs. See attached plans and elevations, Scope of Repair Items 2 and 3, for more information.

Windows and Doors

Remove and replace all window and door assemblies. See attached plans and elevations, Scope of Repair Items 4 and 5, for more information.

Interior Wall Finish

Assume removal and replacement of 100% of building perimeter wall interior gypsum sheathing. Provide an additional 10% allowance for replacement of interior gypsum sheathing damaged during construction activities. Prepare and paint all new interior gypsum board to match adjacent colors. Install new base trim to match existing at all perimeter walls. See attached plans and elevations, Scope of Repair Items 1 and 2, for more information.

Ceiling Replacement

Remove and replace all damaged ceiling finishes affected during construction rehabilitation activities. Provide a 5% allowance for the replacement of ceiling finishes damaged during construction. New ceiling shall match adjacent ceiling type, finish, and color.

Structural Impacts include:

Steel Stud Replacement

Assume removal and replacement of 100% of the steel studs on the south and west elevations. Assume 40% steel stud removal and replacement on the north and east elevations. See attached plans and elevations, Scope of Repair Items 1 and 2, for more information.
Roof Replacement

Remove and replace all roofing on the main roof, as well as the 3 lower roofs. See attached plans and elevations, Scope of Repair Item 6, for more information.

Parapet Extension

The parapet extension will require additional tube steel supports around the perimeter of the roof. Assume new HSS3x3x¼ x3’-0” members will be required at 4'-0” o.c. around the roof perimeter. These will be welded to the steel beams with a ¼” fillet weld all around and fastened to new parapet studs to raise the height of the parapet.

Where no steel beams are present (as on the West and East walls), assume the new studs required for recladding the building are run past the roof framing high to the new parapet height.

Miscellaneous

Electrical at exterior walls

Remove all electrical outlets affected by rehabilitation construction activities. Reinstall electrical outlets after wall repairs have been completed. Provide a 25% allowance for replacement of electrical outlets damaged prior or during construction.
The document contains a detailed list of repair and installation instructions for various aspects of a building project. Key points include:

- **Window Coverings and Surrounds**: All window coverings and wood surrounds at exterior windows and doors are to be removed. These will be stored for reinstallation at project completion.
- **Gypsum Sheet**: All interior gypsum sheeting containing organic growth is to be removed, using proper abatement protocol and disposal.
- **Space Occupied Envelope**: Assumed space is occupied, which is noted in the project scope.
- **Metal Roof Screen**: New metal roof screen and structural roof screen supports are to be installed to match existing height and locations.
- **Insulation**: New insulation is to be installed. This includes 1/4" DensDeck coverboard over tapered insulation and a fully adhered single-ply roofing system with all new flashing and accessories.
- **Roof Deck**: The roof deck is to be replaced with 3/4" T&G roof deck.
- **Existing Roof Drain Replacement**: All existing roof drains are to be replaced.
- **Roof Framing**: All damaged roof framing is to be replaced, assuming 25% existing structural roof framing replacement.
- **Roof Batt Insulation**: 100% of existing roof batt insulation is to be removed.
- **Vapor Barrier**: New vapor barrier (warm side) is to be installed over roof/deck.
- **Metal Flashing**: New metal flashing is to be installed with WRB per WRB manufacturer current installation instructions.
- **Continuous Sealant**: A continuous sealant bed is to be provided below all sill pan flashing.
- **Metal Head Flashing**: Continuous metal head flashing with upturned end dams is to be integrated at all window and door openings.
- **Sill Pans**: New sill pans are to be integrated under new storefront and curtain wall systems, properly integrating with weather resistant barrier systems per manufacturer current installation instructions.
- **Curtain Wall Glazing**: New curtain wall glazing system is to be installed at existing glass block locations.
- **Hollow Metal Doors**: New hollow metal swing doors are to match existing, as occurs.
- **Aluminum Storefront Windows**: New aluminum storefront windows and doors are to match existing sizes and locations.
- **Soldered Joints**: New radius storefront windows are to match existing where possible.
- **Windows and Doors**: All windows, storefront systems, glass blocks, exterior glazed canopies, radius windows, and exterior swing doors are to be removed. Properly disposed of all materials per local AHJ requirements.

The document also includes diagrams illustrating the first, second, and third floors, along with cost estimates and project details. The project is referred to as "THESE DRAWINGS ARE THE PROPERTY OF City Hall Existing Conditions and are not to be used without prior written permission."
**SCOPE OF REPAIR**

**EAST ELEVATION**

- **NORTH ELEVATION**
  - REMOVE AND DISPOSE OF 100% ALL EIFS CLADDING, PAPER FACED GYPSUM SHEATHING, BATT INSULATION, AND ALL CLADDING ASSOCIATED FLASHING/ACCESSORIES; TYPICAL WHERE OCCURS.
  - REMOVE ALL (E) TILE AT (E) PLANTER WALLS. INSTALL NEW LIQUID WRB AND TILE TO MATCH NEW TILING CLADDING, PER MANUFACTURER INSTALLATION INSTRUCTIONS WITH ALL REQUIRED FLASHING AND ACCESSORIES.
  - INSTALL NEW CONCRETE PAVERS AND SUPPORT PEDESTALS WITH ALL ASSOCIATED ACCESSORIES, PER MANUFACTURER CURRENT INSTALLATION INSTRUCTIONS AT TERRACE.
  - INSTALL NEW 3/4" T&G ROOF DECK. INSTALL NEW FULLY ADHERED TAPERED INSULATION, WITH MINIMUM 1/4" PER FOOT SLOPE TO DRAIN. REPLACE ALL EXISTING ROOF DRAINS AND PROVIDE NEW OVERFLOW DRAINS; PROPERLY INTEGRATE WITH WRB PER WRB MANUFACTURER CURRENT INSTALLATION INSTRUCTIONS.
  - DEMO EXISTING ROOF SCREEN AND PROPERLY DISPOSE. DEMO EXISTING ROOF MEMBRANE AT ALL ROOFS, ROOF DECK, PARAPET CAP FLASHING, METAL SKIRTING, AND ALL RELATED FLASHING AND ACCESSORIES (ALL ROOFS).

**SOUTH ELEVATION**

- **WEST ELEVATION**
  - INSTALL NEW CONTINUOUS METAL BACK ANGLE AT ALL WINDOW SILLS, PROPERLY INTEGRATED WITH WRB PER MANUFACTURER'S CURRENT INSTALLATION INSTRUCTIONS.
  - INSTALL NEW PRE-FINISHED METAL FLASHING, PROPERLY INTEGRATED WITH THE WEATHER BARRIER AT ALL PENETRATIONS AND TRANSITIONS BETWEEN DISSIMILAR MATERIALS.
  - PROVIDE CONTINUOUS SEALANT BED BELOW ALL SILL PAN FLASHING. PROVIDE CONTINUOUS METAL HEAD FLASHING WITH UPTURNED END DAMS AT ALL WINDOW AND DOOR OPENINGS; PROPERLY INTEGRATE ALL RELATED MATERIALS.

**CONDITIONS**

- **TYP.**
  - INSTALL NEW LIQUID APPLIED WEATHER RESISTIVE BARRIER PER MANUFACTURER CURRENT INSTRUCTIONS WITH ALL MANUFACTURER REQUIRED FLASHING AND ACCESSORIES.
  - INSTALL NEW FIBERGLASS FACED GYPSUM SHEATHING ON STEEL STUDS ON ALL EXTERIOR WALLS.
  - REMOVE AND REPLACE ALL INTERIOR GYPSUM SHEATHING CONTAINING ORGANIC GROWTH, USING PROPER ABATEMENT PROTOCOL AND DISPOSAL. ASSUME SPACE IS OCCUPIED DURING REMEDIATION. ASSUME 100% INTERIOR GYPSUM SHEATHING REPLACEMENT AT BUILDING PERIMETER WALLS. PROVIDE ALLOWANCE FOR 25% ELECTRICAL WALL OUTLET REPLACEMENT.

- **MEMBERS WILL NEED REPLACEMENT ON THE SOUTH AND WEST ELEVATIONS. ASSUME 40% OF ALL METAL STUDS AND 8% OF STRUCTURAL MEMBERS WILL NEED REPLACEMENT ON THE NORTH AND EAST ELEVATIONS.**
LAKE OSWEGO CITY HALL – VOLUNTARY UPGRADES NARRATIVE

To
City of Lake Oswego

For
Lake Oswego City Hall

Submitted
January 23, 2017

Project Number
2160377.00
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2. Seismic Retrofit Floor Plans  
3. Architectural Floor Plans  
4. Original Architectural and Structural Plans, dated August 1985
I. INTRODUCTION

This narrative describes a list of voluntary upgrades to be priced separately from the envelope replacement narrative, but they are intended to be used in conjunction with one another. The City of Lake Oswego has indicated a desire to pursue some or all the voluntary upgrades listed in this narrative. There are two types of voluntary upgrades listed: architectural and seismic retrofits. The architectural upgrades address cosmetic, finish, or building performance issues. The seismic retrofits provide a list of modifications that could easily be made to the building to improve its performance without fundamentally altering the lateral force resisting system of the building. The seismic retrofits listed all take advantage of related architectural upgrades in order to minimize the cost of their installation.

Each upgrade is to be priced individually, and is keyed to the attached architectural floor plans for clarity.
II. VOLUNTARY ARCHITECTURAL UPGRADES

These upgrades represent a list of building upgrades and maintenance items compiled by the Facilities Department. Where applicable, it should be assumed for pricing purposes that the upgrades are to match existing. Scope has been identified for pricing purposes, but does not represent a final design.

(A1) Elevator Replacement/Modernization

See attached drawings for additional information.

(A2) Front Entrance Replacement

Replace Front arched glazing canopy with storefront system to match existing. See attached drawings for additional information.

(A4) HVAC Replacement

Remove and Replace Existing Mechanical Equipment, and ductwork. See attached drawings for additional information.

(A5) Parking Deck Reskin/Resurfacing

See attached drawings for additional information.

(A6) Public Area Redesign/Remodel – 1st and 3rd Floor

Remodel 1st & 3rd floor including lobbies, and council chambers. Include relocation of interior partitions, lighting, electrical, and HVAC systems.

Assume Restroom locations will remain, but finishes will be upgraded/replaced.

(A7) 2nd Floor Remodel

Remodel 2nd floor to accommodate new City Hall Staff/Department. Include relocation of interior partitions, lighting, electrical, and HVAC systems.

Assume Restroom locations will remain, but finishes will be upgraded/replaced.

(A8) Second Floor Patio Coating

See attached drawings for additional information.
(A9) Front and Rear ADA Entrances

Provide automatic sliding doors at North and South entry vestibules. See attached drawings for additional information.

(A10) Front Entrance Replacement

Replace Front arched glazing canopy with storefront system to match existing. See attached drawings for additional information.

(A11) Wayfinding Signage

Provide a new signage package throughout the building, including code required signage (exiting, restrooms, etc.) and room signage.

(A12) Generator Replacement

Remove Existing Emergency Generator and Upgrade Electrical Systems.
Generator Pad & Paving patching
Delivery/Installation & Commissioning to Install a New Exterior Pad Mounted Emergency Generator, ATS, Sound Enclosure. Assume 50kW
Electrical Systems Upgrades, Natural Gas Fuel Source (including Alternate Fuel Source.) Concrete Pad and Generator Installation Support.

(A13) Parking Garage Enclosure Wall

Remove existing paint & coating from CMU at parking garage and upper parking deck. Properly prep, prime, and re-coat to match existing. Architect to choose color.

(A14) Parking Garage Corrosion Remediation

Where existing steel and piping has corroded within the parking garage, remove corrosion. Properly prepare and paint all steel and piping with a rust-inhibiting coating.
III. VOLUNTARY SEISMIC RETROFITS

Voluntary seismic retrofits are modifications to the building Mackenzie would recommend the City of Lake Oswego implement when the building’s structure is exposed during the re-cladding process or during some of the above named voluntary architectural upgrades. They represent a more limited list of modifications than the full seismic retrofit, and some or all the retrofits may be implemented. Thus, they should be priced on a line item basis without accounting for economies of scale or efficiencies gained by implementing more than one of them.

Diaphragms and Connections

(S1) Ties Between Girders at Roof

This retrofit involves strengthening the connection between steel girders/beams at this level and providing a lateral force path that is dependent solely on welds (rather than a mixture of welds and bolts with unknown pretension values and faying surfaces). While each connection is somewhat different, a typical connection (see sketch V2) involves welding all around the shear tab to the beam and ensuring the shear tab to column connection is welded full up both sides of the plate. Rather than evaluate a custom connection for each case, assume a minimum of 20” of 5/16” (effective throat) fillet weld for each beam at each connection location.

Architectural Impacts

Limited ceiling removal and replacement will be required at each location to provide the required access.

(S2) Ties Between Girders at Levels 1, 2 and 3

This retrofit involves strengthening the connection between steel girders/beams at this level and providing a lateral force path that is dependent solely on welds (rather than a mixture of welds and bolts with unknown pretension values and faying surfaces). While each connection is somewhat different, a typical connection (see sketch V2) involves welding all around the shear tab to the beam and ensuring the shear tab to column connection is welded full up both sides of the plate. Rather than evaluate a custom connection for each case, assume a minimum of 20” of 5/16” (effective throat) fillet weld for each beam at each connection location.

Architectural Impacts

Limited ceiling removal and replacement will be required at each location to provide the required access.

(S3) Ties Across Girders at Roof

The metal web wood joists and engineered wood I-joists of the roof structure require lateral continuity from one side of the diaphragm to the other. To provide the required continuity, straps will be installed across the steel girders from one joist to another. See sketch V1. At the roof level, this involves installing the straps above the roof sheathing but below the roof membrane. For this retrofit, it is assumed the roofing membrane has already been removed and no additional cost need be carried for that work. The lines delineating this retrofit shown in the floor plans are schematic only and are not intended to represent the actual number of straps required.
Architectural Impacts

Ceiling removal and replacement will be required at each location to provide the required access.

(S4) Ties Across Girders at Levels 2 and 3

The metal web wood joists and engineered wood I-joists of the floor structure require lateral continuity from one side of the diaphragm to the other. To provide the required continuity, straps will be installed across the steel girders from one joist to another. See sketch V1. At the floor level, this involves installing the straps above the floor sheathing but below the gypcrete and floor finish. If this retrofit is performed, it is assumed the associated flooring and gypcrete replacements referenced above are also being undertaken. Thus, no additional allowance should be made for the associated demolition and replacement of the floor. The lines delineating this retrofit shown in the floor plans are schematic only and are not intended to represent the actual number of straps required.

Architectural Impacts

Replace existing carpet and flooring throughout building. See attached drawings for additional information.

Provide an allowance for relocation of furniture and demo/replacement of interior wall partitions, as necessary.

Assume full replacement of the gypcrete. Assume built-in casework to remain, unless directly impacted by tie location.

(S5) Replace Dragstruts

Existing 4x4 and glulam beam dragstruts are not sufficient and will require replacement at the 2nd and 3rd floors and the roof. Replace these members with HSS8x4x3/8 members with 2x4 nailer per sketch V3. Attach these nailers to the existing angles embedded in the core walls with welds per the sketch. A portion of the flooring and gypcrete (or roofing) will need to be removed above each dragstrut to allow for nailing of the wood sheathing to the dragstrut. As this is a voluntary upgrade, it is assumed it will only be performed if the roof or floor coverings are also being replaced. Thus, no additional allowance should be made for the associated demolition and replacement of the floor or roof. Provide an allowance for a connection at the far end of the dragstrut to existing steel girders and for shoring the floor/roof framing while the existing member is removed and replaced.

Architectural Impacts

Patch and repair gypcrete. Replace disturbed flooring to match existing.

(S6) Strengthen Perimeter Steel Connections

Where existing steel members exist at the perimeter, the connections between steel beams and the steel columns supporting them should be improved using sketch V2. Access to these members will be provided when the exterior skin is removed. Removal of the exterior skin and wall assembly will necessitate
demolition and replacement of a portion of the ceiling – which will provide access to the interior face of the connection – and should not be double counted for these connection improvements.

**Architectural Impacts**

Ceiling removal and replacement will be required at each location to provide the required access.

Assume minimal impacts to interior wall partitions to provide the required access.
Seismic Retrofit Sketches

NEW SHOTCRETE WALL

#6 @ 12" O.C. EA WAY

#5 DOWELS W/ STD HOOKS @ 1/4" O.C.
EA WAY & EPOXY

SHOTCRETE TO EXISTING WALL

Seismic Retrofit Sketches

By

Jan 2017

Date

2160377.00

Job #

Shr. 1 of 14

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Seismic Retrofit Sketches

NEW SHOTCRETE WALL PER S1
REINF. & HOOKS PER S1

EXISTING WALL (CONC OR 8" CMU)

DOWEL VERT REINF INTO EXISTING FOOTING UN EPOXY

SHOTCRETE TO WALL FOUNDATION
Seismic Retrofit Sketches

NEW SHOTCRETE WALL PER S1

EXISTING CONCRETE CORE WALL

EXISTING GRADE BEAM AND REINF

EMBED VERT REINF 18' MIN W/ EPOXY

SHOTCRETE TO CORE FOUNDATION

By: 
Date: Jan 2017
Job #: 2160377.00

Seismic Retrofit Sketches

Architecture • Interiors • Planning • Engineering

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Shr. 3 of 14
Seismic Retrofit Sketches

- Existing topping slab
- Existing hollowcore plank
- New #4 dowel w/ std. hook and 6" epoxy embedment & 24" o.c.
- New shotcrete drag strut
- #5 U-bars & 12" o.c. w/ epoxy embed to existing conc. wall
- Existing concrete wall
- (4) #10 w/#4 hoops & 6" o.c.
- New shotcrete wall per
- Terminate vert. reinf. w/ std. hook

54 Dragstrut to parking deck

Jan 2017
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Seismic Retrofit Sketches

1. Strengthen beams @ Level 3, BT, grids 'A' & 'C', and 'G' &
2. Strengthen beam @ Z, at Level 3, grids 'G' & 'I'
3. Strengthen columns @ grids 'G' & 'I'
4. Assume all gusset plates are z=1, a=20

B1: Braced Frame at Grid 1

NOTES:

NEW CONC PILASTERS PERS
SHOTRENS WILD PER SHA

HSS 4" x 0.25" PIPE BRACE, TYP. (#) PLACES
HSS 6" x 0.25" PIPE BRACE, TYP. (#) PLACES

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Seismic Retrofit Sketches

1. Assume all gussets are 3/4" A36

B2 - Braced Frame at Grid 9

NOTES:

Seismic Retrofit Sketches

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Sh. 6 of 14

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Seismic Retrofit Sketches

NOTES:
1. COLUMNS ARE REPLACED
2. ASSUME ALL GUSSET PLATES ARE 3/16" A36

BRACED FRAME AT GRID 'L'

By ____________________________

Date __________________________

Job # __________________________

Sht. __ of ___

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Seismic Retrofit Sketches

NOTES:
1. NEW BEAMS & COLUMN
2. ASSUME ALL GUSSETS ARE 3/4" A36

B4 BRACED FRAME AT GRID 'A'

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NEW CONCRETE PILASTER

(3) #10 VERT

#4 @ 6" O.C.

NEW SHOTCRETE PILASTER BELOW COLUMN ABOVE

EXISTING CONCRETE RETAINING WALL.

CHIP OUT & LEAVE REINFORCING IN PLACE

B5

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9 14

Jan 2017

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Seismic Retrofit Sketches

Enlarged Concrete Pilaster

Shotcrete pilaster w/ (B) w/o vert

#4 U-bars 6" o.c. staggered, drill & epoxy through wall

180° #4 hooks 6" o.c. w/ epoxy embedded

Existing wall & pilaster
CROSS TIES

Seismic Retrofit Sketches

By

Jan 2017

Date

2160377.00

Job #

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Sh. 12 of 14

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NOTE:
ASSUME A MINIMUM OF 2O OF 5/16" FILLER WELD IS REQUIRED PER BEAM PER CONNECTOR.

IMPROVED GIRDER TO GIRDER CONNECTION V2
Seismic Retrofit Sketches

Existing Conc Wall
Chip out 1'-6" wide strip of 1" concrete and replace
Nail shim to Drag strut w/ 10d & 4" O.C.
Existing L4x3x1/4
New HSS 8x4x3/8
Attach nailer w/ Hilti x-u din @ 6" O.C., stag.

NEW TUBE STEEL DRAGSTRUT
LEGEND: SCOPE OF REPAIR

- **VOLUNTARY UPGRADES**
  - PARAPET CAP FLASHING AT PERIMETER DECK WALLS. REMOVE EXISTING DECK GUARDRAILS; PROPERLY PREP AND PAINT TO BE REINSTALLED, PROPERLY INTEGRATED WITH NEW WRB AND EIFS CLADDING.

- INSTALL MIN. 1/4" PER FOOT. INSTALL NEW FULLY SOLDERED SADDLE FLASHING AT PARAPET TO WALL TRANSITIONS, PROPERLY INTEGRATED WITH WRB PER MANUFACTURER.

- INSTALL NEW METAL STANDING SEAM INSTALL NEW FULLY SOLDERED SILL PAN AT ACCESS DOOR, PROPERLY INTEGRATED WITH NEW WATERPROOF MEMBRANE. INSTALL NEW 2-1/2" CONCRETE TOPPING SLAB TO MATCH (E), SLOPED TO (E) DRAINS.

- PER MANUFACTURER INSTALLATION INSTRUCTIONS. PROPERLY INTEGRATE WATERPROOFING TRANSITIONS AT ALL DECK TO WALL LOCATIONS, CORNERS, THRESHOLDS, AND DECK DRAINS PER MANUFACTURER.

- WITH NEW 3/4" CDX PLYWOOD TO MATCH EXISTING. INSTALL NEW WATERPROOF MEMBRANE, DRAINAGE MAT, PROTECTION BOARD, AND ALL MANUFACTURER REQUIRED FLASHINGS AND ACCESSORIES.

- REMOVE EXISTING PEDESTRIAN TRAFFIC COATING, CONCRETE TOPPING SLAB, WATERPROOF MEMBRANE, PROTECTION BOARD, AND ALL CARPET AT ALL CARPET LOCATIONS. INSTALL NEW GYPCRETE AND NEW CARPET.

- REMOVE GLASS NORTH ENTRY CANOPY. INSTALL NEW GLASS CANOPY TO MATCH EXISTING. PROPERLY INTEGRATE WITH FLASHING, WRB AND CLADDING AT THE WALL TRANSITIONS.

- REMOVE (3) EXISTING ELEVATORS (TWO 4-STOP AND ONE 2-STOP) AND ALL ASSOCIATED ACCESSORIES, EQUIPMENT, AND FINISHES. INSTALL NEW ELEVATORS AND EQUIPMENT PER MANUFACTURER.

- REMOVE ALL EXISTING HVAC EQUIPMENT, DUCTS, AND ACCESSORIES. INSTALL NEW HVAC SYSTEM, DUCTS, AND ACCESSORIES PER CURRENT MECHANICAL CODE.

- REMOVE ALL EXISTING 1ST, 2ND AND 3RD FLOOR CARPET. REMOVE GYPCRETE AT ALL CARPET LOCATIONS. INSTALL NEW GYPCRETE AND NEW CARPET.

- REMOVE EXISTING TRAFFIC COATING FROM THE ELEVATED PARKING DECK. PROPERLY PREPARE DECK SUBSTRATE TO RECEIVE NEW TRAFFIC COATING PER MANUFACTURER'S CURRENT INSTALLATION INSTRUCTIONS.

- PROPERLY REMOVE EXISTING TRAFFIC COATING FROM THE ELEVATED PARKING DECK. PROPERLY PREPARE DECK SUBSTRATE TO RECEIVE NEW TRAFFIC COATING PER MANUFACTURER INSTALLATION INSTRUCTIONS WITH ALL MANUFACTURER REQUIRED FLASHING AND ACCESSORIES.

- REMOVE ALL EXISTING HVAC EQUIPMENT, DUCTS, AND ACCESSORIES. INSTALL NEW HVAC SYSTEM, DUCTS, AND ACCESSORIES PER CURRENT MECHANICAL CODE.

- REMOVE ALL EXISTING HVAC EQUIPMENT, DUCTS, AND ACCESSORIES. INSTALL NEW HVAC SYSTEM, DUCTS, AND ACCESSORIES PER CURRENT MECHANICAL CODE.

- REMOVE ALL EXISTING 1ST, 2ND AND 3RD FLOOR CARPET. REMOVE GYPCRETE AT ALL CARPET LOCATIONS. INSTALL NEW GYPCRETE AND NEW CARPET.
LAKE OSWEGO CITY HALL – FULL SEISMIC RETROFIT NARRATIVE

To
City of Lake Oswego

For
Lake Oswego City Hall

Submitted
January 23, 2017

Project Number
2160377.00
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# ATTACHMENTS

1. Seismic Retrofit Sketches by Mackenzie, dated January 2017
2. Seismic Retrofit Floor Plans, by Mackenzie, dated January 2017
I. INTRODUCTION

The purpose of this narrative is to describe the various structural seismic retrofits proposed for the Lake Oswego City Hall building, the extent of those retrofits, and the architectural impacts of installing such retrofits. This information will then be used by a cost estimator to develop cost estimates for both full and partial or voluntary seismic retrofit approaches.

This narrative assumes that the interior floor plans (i.e. interior partition walls, doors, ceilings, casework, etc.) will remain as existing, except where removal and replacement is required during construction. Cost estimates for interior remodel is included in the Voluntary Architectural Upgrades, and would be in addition to the following scope.

The need for these retrofits is driven by the proposed replacement of the existing exterior skin system of the City Hall building. If a new material is chosen for the skin system, an upgrade of the building’s seismic force resisting system may be triggered as detailed in the companion seismic assessment to this narrative. If the building’s skin is replaced with a more functional version of its existing skin system it may not necessarily trigger mandatory seismic retrofits, but would afford the City the opportunity to install voluntary seismic retrofits with the lowest possible secondary costs due to the easy access to exposed structural systems. The City of Lake Oswego has expressed an interest in the relative costs of both a full seismic retrofit of the building and of the cost of each proposed voluntary seismic retrofit.

The retrofits proposed in this narrative (and it associated graphics) represent a concept level of design. While Mackenzie has endeavored to consider all the possible types of retrofits that may be required, there are many ways to retrofit a given building and the methods proposed in this narrative are only one. While we believe these approaches to be the most cost effective, the final design of such retrofits depends heavily on the architectural, structural, and spatial constraints of each unique location and on the preferences and availability of various contractors. The cost estimates developed based on this narrative should be considered order of magnitude estimates with the understanding that some elements may require additional or more complex retrofits than proposed here and some elements may not require retrofits at all.

In developing cost estimates based on this narrative, it is critical that auxiliary costs and the complexity of the work be considered. For example, when considering the costs to install a new foundation or modify an existing one, the demolition of existing concrete or landscape elements, the need to work in congested/limited access areas, etc. should be included by escalating the cost of the foundation work above what would be required for foundation in a new building. Or when considering the replacement of an existing framing member, consideration should be made for shoring up members supported by that member when developing the replacement cost.
II. FULL SEISMIC RETROFIT

The full seismic retrofit is a list of those modifications to the building necessary to bring the building into conformance with the building code.

Foundations

**Pad Footings Below Cores**

Increase the size of (11) pad footings supporting the concrete stair/elevator cores to 6'-0"x6'-0"x20" by adding concrete around the perimeter of the existing pad footings and connecting with reinforcing epoxy dowelled 42" into existing footings. Assume (9) #6 each way. (4) existing footings are 4'-0"x4'-0", and (7) are 5'-0"x5'-0". The footings to be modified are indicated on plan.

Access to the footings will require demolition of the slab on grade above, some excavation, re-compaction, and replacing the slab on grade (5" thick with #4 @ 24" O.C. each way).

**Pad Footings Below Concrete Columns**

Increase the size of (1) pad footing located at gridline intersection 9-J. The existing foundation is 5'-0"x5'-0"x20". Increase the size of the foundation to 7'-0"x7'-0"x20" by adding concrete around the perimeter of the existing pad footing and connecting with reinforcing epoxy dowelled 42" into existing footings. Assume (9) #6 each way. The footing to be modified is indicated on plan.

Access to the footings will require demolition of the slab on grade above, some excavation, re-compaction, and replacing the slab on grade (5" thick with #4 @ 24" O.C. each way).

**Architectural Impacts**

Miscellaneous Parking Striping at disturbed areas

**New Foundations at Street Level**

New braced frames (addressed below) will be required on the west side of the building at street level and will require new continuous footings to support them. Two frames will be added on gridline ‘L’ between gridlines 2 and 4 and between gridlines 5 and 7. The new foundations will be 5'-0" x 36'-0" x 36" with (8) #8 longitudinal and #6 @ 12" O.C. transverse top and bottom, and (4) #4 stirrups @ 12” O.C.

These new foundations will replace the (6) existing 4'-0"x4'-0" pad footings present underneath the columns at these locations. To install the continuous footings, the existing columns will need to be shored up and supported while the pad footings are removed and the new continuous footings are installed.

**Architectural Impacts**

Removal/replacement of planters and affected landscaping. Repair/Replace adjacent stairs and sidewalk, as necessary.
**Foundations Below Basement Walls**

New braced frames (addressed below) will be added to gridlines 1 and ‘A’ and will bear on existing basement retaining walls and concrete pilasters. The foundations below these walls and pilasters will need to be enlarged. The existing pilasters (where present) are 12”x16” and the walls are 8” thick. The existing foundations are 5’-0” square with a 2’-0” x 12” continuous footing between. The new footings should be 6’-0” x 18” and either 36’-0” or 21’-0” long. Assume (8) #8 longitudinal and #6 @ 12” O.C. transverse top and bottom, and (3) #4 hoops @ 12” O.C.

The footing on gridline 1 will be installed eccentrically while the footing on gridline ‘A’ will require excavation in the alley in order to install it concentrically. Access to the footings will require demolition of the slab on grade above, some excavation, re-compaction, and replacing the slab on grade (5” thick with #4 @ 24” O.C. each way).

**Foundations Below Elevated Garage Walls**

Existing walls on three sides of the elevated parking deck will be strengthened with shotcrete and will draw additional shear forces from the remaining walls. As a result, the foundations under these walls will need to be enlarged. The existing continuous foundations are 24”x12”. The new footings should be 4’-0”x18” w/ (4) additional #6 longitudinal and #6 @ 12” O.C. transverse top and bottom epoxy dowelled through the existing foundations to the other side. Foundations under walls on gridlines ‘A’ and 12 will be installed concentrically while the one near gridline ‘K’ will be installed eccentrically.

Access to the footings will require demolition of the slab on grade above, some excavation, re-compaction, and replacing the slab on grade (5” thick with #4 @ 24” O.C. each way).

**Wall Retrofits**

**Core Walls**

There are three concrete/masonry cores in the building that extend from the basement up to the roof of the structure. These walls require strengthening which will be accomplished with the addition of 4” of shotcrete to the outside faces of the cores (see plans). The shotcrete assembly will be connected to the existing walls with epoxy dowels and will be installed as shown in sketch S1 and will be continuous from foundation to roof. The shotcrete will be epoxy dowelled into the grade beams at the base of the building per sketch S3.

An allowance should be made for removing the structural ledgers/structural supports at each floor level and replacing them. This will require temporary shoring to support the floor structure while the shotcrete is added and a new ledger is installed. It will also require modification of joist lengths and demolition/replacement of the floor assembly around the affected walls and at the roof.

**Architectural Impacts**

To install the new shotcrete walls, existing architectural finishes will need to be removed and replaced. For the walls, this includes removal and replacement of furring and/or paint, as occurs; cleaning, signage removal, and modifications of HVAC ductwork that penetrates the core walls at each floor. The ceiling grid and flooring will need to be removed and replaced for several feet around the working area.
**Basement Retaining Walls**

Basement retaining walls and pilasters (where they occur) below the new braced frames will require supplementation to resist the new loads imparted by the braced frames. Typically, this will entail 4” of new shotcrete on the inside face of the wall with epoxy dowels to the existing wall and to the footing below per sketches S1 and S2. Along gridline 1, this will involve the addition of two new concrete pilasters to align with the columns above per sketch S5. Along gridline A, this will involve the addition of one new concrete pilaster and the expansion of two existing pilasters per sketch S6.

An allowance should be made for the attachment of the braced frame columns to the pilasters below. This will likely involve significant epoxy embedment of large diameter anchor bolts.

**Walls Supporting Elevated Parking Deck**

Four existing concrete walls supporting the elevated parking deck will be supplemented with 4” of additional shotcrete. This will entail epoxy dowels to the existing wall and to the footing below per sketches S1 and S2. To tie the elevated parking deck together, 12”x12” dragstruts will be added around the perimeter of the deck on three sides and integrated with the new shotcrete walls per sketch S4. This dragstrut will be formed with either pumped grout or with shotcrete.

**Architectural Impacts**

Where the shotcrete is to be applied to the exterior face of a wall, an allowance should be made for removing the existing finish coat and paint and for applying a new finish coat and paint to match existing, after completion of the shotcrete work.

**New Braced Frames**

**Gridline 1**

New braced frames will be required along gridline ‘1’ to eliminate the cantilevered wood diaphragms as shown in sketch B1. At the 3rd floor this involves the addition of two bays of braces made of HSS pipes in an X-configuration and the addition of two new tube steel columns at the ends of the roof diaphragm to enclose the braced frames. At the 1st and 2nd floors, this involves the addition of one bay of braces made of HSS pipes in an X-configuration.

Three beams referenced in sketch B1 will require strengthening to support the new loads. Strengthening will include the addition of ½” steel plate stitch welded to the webs of the beams and welding (4) angles (assume L6x4x3/8) to the upper and lower flanges of the beams. The two columns located on gridlines ‘G’ and ‘I’ will also require strengthening. Strengthening will include stitch welding (2) channels (assume MC8x22.8) to the columns between floor levels.

Field installed gusset plates are required at each brace/column/beam intersection and at each brace/brace intersection. Assume all gussets are made from ¼” thick A36 steel. An allowance should be made for each gusset plate and for the field installation of each gusset plate.

Modifications of the supporting basement wall/pilaster/foundation are described elsewhere.
Architectural Impacts

Remove and replace intersecting interior partition walls, flooring, ceilings, and roofing, and partial demolition and replacement of the floor assembly to accommodate installation of braced frames. Modification of window sizes and/or locations may be required, but it should be assumed for pricing purposes that the overall glazing take-offs will remain the same.

Gridline 9

New braced frames will be required along gridline ‘9’ to eliminate the cantilevered wood diaphragms as shown in sketch B2. At the 1st through 3rd floors this involves the addition of one bay of braces made of HSS pipes in an X-configuration.

Due to the offset in brace locations, the existing steel beam referenced in sketch B2 will require strengthening to support the new loads. Strengthening will include the addition of 1/2” steel plate stitch welded to each side of the web of the beam and welding (4) angles (assume L6x4x3/4) to the upper and lower flanges of the beams. Additionally, (3) concrete columns will require strengthening. Column improvements will involve adding 6” of concrete around the perimeter of the columns with epoxy dowels to the existing column, (10) #8 verts, and #3 hoops at 6” o.c., similar to sketch S6.

Field installed gusset plates are required at each brace/column/beam intersection and at each brace/brace intersection. Assume all gussets are made from ¾” thick A36 steel. An allowance should be made for each gusset plate and for the field installation of each gusset plate.

Modifications of the existing footings beneath this braced wall line are described elsewhere in this document.

Architectural Impacts

Remove and replace intersecting interior partition walls, flooring, ceilings, and roofing, and partial demolition and replacement of the floor assembly to accommodate installation of braced frames. Modification of window sizes and/or locations may be required, but it should be assumed for pricing purposes that the overall glazing take-offs will remain the same.

Gridline ‘L’

(2) new braced frames will be required along gridline ‘L’ to eliminate the cantilevered wood diaphragms as shown in sketch B3. At the 1st through 3rd floors, this involves the addition of two bays of braces made of HSS pipes in a chevron configuration. These frames will do not extend to the basement level.

The (6) existing columns at these locations are inadequate and will be replaced with new wide flange columns. No steel beams currently exist at these locations at the floor levels, so new wide flange beams will be installed per sketch B3.

Field installed gusset plates are required at each brace/column/beam intersection and at each brace/brace intersection. Assume all gussets are made from ¾” thick A36 steel. An allowance should be made for each gusset plate and for the field installation of each gusset plate.

Modifications of the existing footings beneath this braced wall line are described elsewhere in this document.
Architectural Impacts

Demolition and removal of the existing planters at these locations should be accounted for. The planters are not intended to be replaced.

Remove and replace intersecting interior partition walls, flooring, ceilings, and roofing, and partial demolition and replacement of the floor assembly to accommodate installation of braced frames. Modification of window sizes and/or locations may be required, but it should be assumed for pricing purposes that the overall glazing take-offs will remain the same.

Gridline ‘A’

A new braced frame will be required along gridline ‘A’ to eliminate the cantilevered wood diaphragms as shown in sketch B4. At the 1st through 3rd floors, this involves the addition of one bay of braces made of HSS pipes in a chevron configuration. The improvements to the concrete wall/pilasters below are addressed elsewhere in this narrative.

No column currently exists at gridline 4, so a new wide flange column and a supporting pilaster below will need to be installed. The two existing columns at the outside of this braced frame at grids 3 and 5 will also require strengthening. Strengthening will include stitch welding (2) channels (assume MC8x22.8) to the columns between floor levels.

No steel beams currently exist at these locations at the floor levels, so new wide flange beams will be installed per sketch B4.

Field installed gusset plates are required at each brace/column/beam intersection and at each brace/brace intersection. Assume all gussets are made from ¾” thick A36 steel. An allowance should be made for each gusset plate and for the field installation of each gusset plate.

Modifications of the existing footings beneath this braced wall line are described elsewhere in this document.

Architectural Impacts

Remove and replace intersecting interior partition walls, flooring, ceilings, and roofing, and partial demolition and replacement of the floor assembly to accommodate installation of braced frames. Modification of window sizes and/or locations may be required, but it should be assumed for pricing purposes that the overall glazing take-offs will remain the same.

Diaphragms and Connections

Ties Between Girders at Roof

This retrofit involves strengthening the connection between steel girders/beams at this level and providing a lateral force path that is dependent solely on welds (rather than a mixture of welds and bolts with unknown pretension values and faying surfaces). While each connection is somewhat different, a typical connection (see sketch V2) involves welding all around the shear tab to the beam and ensuring the shear tab to column connection is welded full up both sides of the plate. Rather than evaluate a custom
connection for each case, assume a minimum of 20” of 5/16” (effective throat) fillet weld for each beam at each connection location.

Architectural Impacts

Limited ceiling removal and replacement will be required at each location in order to provide the required access.

Ties Between Girders at Levels 1, 2 and 3

This retrofit involves strengthening the connection between steel girders/beams at this level and providing a lateral force path that is dependent solely on welds (rather than a mixture of welds and bolts with unknown pretension values and faying surfaces). While each connection is somewhat different, a typical connection (see sketch V2) involves welding all around the shear tab to the beam and ensuring the shear tab to column connection is welded full up both sides of the plate. Rather than evaluate a custom connection for each case, assume a minimum of 20” of 5/16” (effective throat) fillet weld for each beam at each connection location.

Architectural Impacts

Limited ceiling removal and replacement will be required at each location in order to provide the required access.

Ties Across Girders at Roof

The metal web wood joists and engineered wood I-joists of the roof structure require lateral continuity from one side of the diaphragm to the other. To provide the required continuity, straps will be installed across the steel girders from one joist to another. See sketch V1. At the roof level, this involves installing the straps above the roof sheathing but below the roof membrane. For this retrofit, it is assumed the roofing membrane has already been removed and no additional cost need be carried for that work. The lines delineating this retrofit shown in the floor plans are schematic only and are not intended to represent the actual number of straps required.

Architectural Impacts

Ceiling removal and replacement will be required at each location to provide the required access.

Ties Across Girders at Levels 2 and 3

The metal web wood joists and engineered wood I-joists of the floor structure require lateral continuity from one side of the diaphragm to the other. To provide the required continuity, straps will be installed across the steel girders from one joist to another. See sketch V1. At the floor level, this involves installing the straps above the floor sheathing but below the gypcrete and floor finish. To complete this retrofit, a portion of flooring and gypcrete will need to be removed at the spacing of the straps and replaced once the retrofit is complete. The lines delineating this retrofit shown in the floor plans are schematic only and are not intended to represent the actual number of straps required.
**Architectural Impacts**

Replace existing carpet and flooring throughout building. See attached drawings for additional information.

Provide an allowance for relocation of furniture and demo/replacement of interior wall partitions, as necessary.

Assume full replacement of the gypcrete. Assume built-in casework to remain, unless directly impacted by tie location.

**Replace Dragstruts**

Existing 4x4 and glulam beam dragstruts are not sufficient and will require replacement at the 2nd and 3rd floors and the roof. Replace these members with HSS8x4x3/8 members with 2x4 nailer per sketch V3. Attach these nailers to the existing angles embedded in the core walls with welds per the sketch. A portion of the flooring and gypcrete (or roofing) will need to be removed above each dragstrut to allow for nailing of the wood sheathing to the dragstrut. Provide an allowance for a connection at the far end of the dragstrut to existing steel girders and for shoring the floor/roof framing while the existing member is removed and replaced.

**Architectural Impacts**

Patch and repair gypcrete. Replace disturbed flooring to match existing.

**Strengthen Perimeter Steel Connections**

Where existing steel members exist at the perimeter, the connections between steel beams and the steel columns supporting them should be improved using sketch V2. Access to these members will be provided when the exterior skin is removed. Removal of the exterior skin and wall assembly will necessitate demolition and replacement of a portion of the ceiling – which will provide access to the interior face of the connection – and should not be double counted for these connection improvements.

**Architectural Impacts**

Ceiling removal and replacement will be required at each location to provide the required access.

Assume minimal impacts to interior wall partitions to provide the required access.
III. EXTERIOR SKIN REPLACEMENT

In conjunction with the full seismic retrofit, the City Hall building will be re-clad with Insulated Metal Panel. See Attached drawings for additional information.

Finish Impacts include:

Metal Panel Cladding

Remove and replace all EIFS cladding, where occurs. See attached plans and elevations, Scope of Repair Item 1, for more information.

Tile Cladding

Remove and replace all tile cladding, where occurs. See attached plans and elevations, Scope of Repair Items 2 and 3, for more information.

Windows and Doors

Remove and replace all window and door assemblies. See attached plans and elevations, Scope of Repair Items 4 and 5, for more information.

Interior Wall Finish

Assume removal and replacement of 100% of building perimeter wall interior gypsum sheathing. Provide an additional 10% allowance for replacement of interior gypsum sheathing damaged during construction activities. Prepare and paint all new interior gypsum board to match adjacent colors. Install new base trim to match existing at all perimeter walls. See attached plans and elevations, Scope of Repair Items 1 and 2, for more information.

Carpet Replacement

Remove and replace carpet affected during construction rehabilitation activities. Provide a 5% allowance for replacement of carpet damaged during construction. New carpet shall match existing.

Ceiling Replacement

Remove and replace all damaged ceiling finishes affected during construction rehabilitation activities. Provide a 5% allowance for the replacement of ceiling finishes damaged during construction. New ceiling shall match adjacent ceiling type, finish, and color.

Structural Impacts include:

Steel Stud Replacement

Assume removal and replacement of 100% of the steel studs on the south and west elevations. Assume 40% steel stud removal and replacement on the north and east elevations. See attached plans and elevations, Scope of Repair Items 1 and 2, for more information.
Roof Replacement

Remove and replace all roofing on the main roof, as well as the 3 lower roofs. See attached plans and elevations, Scope of Repair Item 6, for more information.

Parapet Extension

The parapet extension will require additional tube steel supports around the perimeter of the roof. Assume new HSS3x3x⅛ x3'-0" members will be required at 4'-0” o.c. around the roof perimeter. These will be welded to the steel beams with a ¼" fillet weld all around and fastened to new parapet studs to raise the height of the parapet.

Where no steel beams are present (as on the West and East walls), assume the new studs required for recladding the building are run past the roof framing high to the new parapet height.

Miscellaneous

Electrical at exterior walls

Remove all electrical outlets affected by rehabilitation construction activities. Reinstall electrical outlets after wall repairs have been completed. Provide a 25% allowance for replacement of electrical outlets damaged prior or during construction.
Seismic Retrofit Sketches

NEW SHOTCRETE WALL

#6 2 12" O.C. EA WAY

1" GFR

#5 BOWELS W/ STD HOOKS 2 1/4" O.C. EA WAY & EPOXY EMBED

SHOTCRETE TO EXISTING WALL
Seismic Retrofit Sketches

- NEW SHOTCRETE WALL PER S4
- REINF. & HOOKS PER S1
- EXISTING WALL (CNC OR B" CMU)
- DOWEL VERT REINF INTO EXISTING FOOTING W/ EPOXY

SHOTCRETE TO WALL FOUNDATION

Seismic Retrofit Sketches

By

Jan 2017

Date

2160377.00

Job #

Shr. 2 of 14

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Seismic Retrofit Sketches

New Shotcrete Wall Per Site
Existing Concrete Core Wall
Existing Grade Beam and Rein
Embed Vert Reinf 18" Min W/ Epoxy

Shotcrete to Core Foundation

Seismic Retrofit Sketches

Portland, OR
503.224.9560
Vancouver, WA
360.695.7879
Seattle, WA
206.749.9993

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Sht. 3 of 14

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Seismic Retrofit Sketches

**Existing Topping Slab**

**Existing HollowCore Plank**

**New #4 Dowel w/ std. hook and 6" epoxy embedment & 24" O.C.**

**New Shotcrete Drag Strut**

**#5 U-bars @ 12" O.C. w/ epoxy embed to existing conc. wall**

**Existing Concrete Wall**

**#10 w/@4 hoops & 6" O.C.**

**New Shotcrete Wall Per**

**Terminate Vert. Reinforced w/ std. hook**

54 Dragstrut to Parking Deck

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**By:**  
**Date:** Jan 2017  
**Job #:** 2160377.00  
**Sh #:** 4 of 14
Seismic Retrofit Sketches

1. Strengthen beams @ Level 3, B1, grids W & C, and 'G' & 'H'.
2. Strengthen beam @ Level B, grids G & I.
3. Strengthen columns @ grids G & I.
4. Assume all gusset plates are 3/4" A36.

B1: BRACED FRAME AT GRID 1

NEW CONC PILASTERS PER PB.
SHOTCRETE WALL PER EA.

MITER ANGLES 7-1/2.

HSS 4"X 0.250 PIPE BRACED, TYP. (4) PLACES.
NEW COLS, (3) PLACES.

DIRECTIONS: DRAWER M.

2160377.00
Jan 2017

By

Jan 2017

2160377.00

Job #

Sh. 5 of 14

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NOTES:
1. ASSUME ALL Gussets ARE 1/4" A36
NOTES:
1. COLUMNS ARE REPLACED
2. ASSUME ALL GUSSET PLATES ARE 3/16 A360

BRACED FRAME AT GRID 'L'
Seismic Retrofit Sketches

3rd Floor

2nd Floor

1st Floor

BASEMENT

NOTES:
1. NEW BEAMS & COLUMN
2. ASSUME ALL GUSSETS ARE 3/4" A36

B4

BRACED FRAME AT GRID 'A'

RoOF

(n) WRX 82, TYP.

(HS) G270

(E) T.S. G6 x 6/16

(E) G6 x 6/16

ENLARGED FOUNDATION

SHOTCRETE WALL PER S1

PILASTER PER B6
Seismic Retrofit Sketches

NEW CONCRETE PILASTER

(3) #10 VERT
#4 @ 6" O.C.

NEW SHOTCRETE PILASTER BELOW COLUMN ABOVE
EXISTING CONCRETE RETAINING WALL
CHIP OUT & LEAVE REINFORCING IN PLACE

B5

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Jan 2017

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Seismic Retrofit Sketches

E N L A R G E D  C O N C R E T E  P I L A S T E R

SHOTCRETE PILASTER w/ (B) UND VERT

#4 U-BARS & 6" O.C.
STAGGERED, DRILL & EPOXY THROUGH WALL

180° #4 HOLES &
6" O.C. W/ EPOXY
EMBED

EXISTING WALL & PILASTER

B6

Seismic Retrofit Sketches

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Date

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Job #

Sht. 10 of 14

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Seismic Retrofit Sketches

CHIP OUT & REPLACE 1/2" GYPSUM (NOT REQ'D @ ROOF)

SIMPSON MSTC.28 @ 48" OC. MAX

EXISTING GIRDER & NAILED

FLOOR OR ROOF SHEATHING

EXISTING TSL & TSLX AS OCCUPES

V1 CROSS TIES

Seismic Retrofit Sketches

By

Jan 2017

Date

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Sh. 12 of 14

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NOTE:
ASSUME A MINIMUM OF 2D" OF 5/16" FILLER WELD IS REQUIRED PER BEAM PER COIL.

IMPROVED GIRDER TO GIRDER CONNECTION
Seismic Retrofit Sketches

Existing Conc Wall

Chip out 1-5" wide strip of 1" CBG concrete and replace

Nail shim to drag strut w/ 108 @ 6" O.C.

Existing L4x3x1/4

New HSS 8x4x3/8

Attach nailer w/ Hilti x-wl din @ 6" O.C., stagger.

NEW TUBESTEEL DRAGSTRUT

V3

Jan 2017

2160377.00

14

14
REMOVE AND REPLACE ALL INTERIOR GYPSUM SHEATHING CONTAINING ORGANIC GROWTH, USING PROPER ABATEMENT PROTOCOL AND DISPOSAL. AS SUME SPACE IS OCCUPIED

INTERIOR REPAIRS (BASE BID)

STANDING SEAM PARAPET CAP FLASHING AT PARAPET PERIMETER. INSTALL FULLY SOLDERED SADDLE FLASHING AT ALL PARAPET TO WALL TRANSITIONS. PROPERLY INTEGRATE SADDLE FLASHING WITH WRB, CLADDING AND INSTALLATION INSTRUCTIONS. INSTALL NEW CONCRETE PAVERS AND SUPPORT PEDESTALS WITH ALL ASSOCIATED ACCESSORIES, PER MANUFACTURER CURRENT INSTALLATION INSTRUCTIONS AT TERRACE. INSTALL NEW OVERFLOW OUTLETS WITH WRB, CLADDING, AND ROOFING PER MANUFACTURER. ENSURE OVERFLOW DRIP EXTENDS PAST THE FACE OF THE EIFS CLADDING. EXTEND EXISTING DRAIN PIPES TO ACCOUNT FOR NEW TAPERED 3/4" T&G ROOF DECK. INSTALL NEW FULLY ADHERED TAPERED INSULATION, WITH MINIMUM 1/4" PER FOOT SLOPE TO DRAIN. REPLACE ALL EXISTING ROOF DRAINS AND PROVIDE NEW OVERFLOW DRAINS; PROPERLY INTEGRATE

REPLACE ALL DAMAGED ROOF FRAMING, ASSUME 25% EXISTING STRUCTURAL ROOF FRAMING REPLACEMENT. REMOVE AND REPLACE 100% OF EXISTING ROOF BATT INSULATION. INSTALL NEW VAPOR BARRIER (WARM SIDE) AND ROOF/DECK (BASE BID)

METAL FLASHING WITH WRB PER WRB MANUFACTURER CURRENT INSTALLATION INSTRUCTIONS. PROVIDE CONTINUOUS SEALANT BED BELOW ALL SILL PAN FLASHING. PROVIDE CONTINUOUS METAL HEAD FLASHING WITH UPTURNED END DAMS AT ALL WINDOW AND DOOR OPENINGS; PROPERLY INTEGRATE O

OCCURS. INSTALL NEW CURTAIN WALL GLAZING SYSTEM AT EXISTING GLASS BLOCK LOCATIONS. INSTALL NEW HOLLOW METAL SWING DOORS TO MATCH EXISTING, AS OCCURS. PROVIDE FULLY SOLDERED WINDOWS/DOORS (BASE BID)

PROPERLY REMOVE EXISTING TRAFFIC COATING FROM THE ELEVATED PARKING DECK. PROPERLY PREPARE DECK SUBSTRATE TO RECEIVE NEW TRAFFIC COATING PER MANUFACTURER'S CURRENT INSTALLATION INSTRUCTIONS. INSTALL NEW TRAFFIC COATING PER MANUFACTURER INSTALLATION INSTRUCTIONS WITH ALL MANUFACTURER REQUIRED FLASHING AND ACCESSORIES.

REMOVE ALL EXISTING 1ST, 2ND AND 3RD FLOOR CARPET. REMOVE GYPCRETE AT ALL CARPET LOCATIONS. INSTALL NEW GYPCRETE AND NEW CARPET

REMOVE GLASS NORTH ENTRY CANOPY. INSTALL NEW GLASS CANOPY TO MATCH EXISTING. PROPERLY INTEGRATE WITH FLASHING, WRB AND CLADDING AT THE WALL TRANSITIONS.

REMOVE (3) EXISTING ELEVATORS (TWO 4-STOP AND ONE 2-STOP) AND ALL ASSOCIATED ACCESSORIES, EQUIPMENT, AND FINISHES. INSTALL NEW ELEVATORS AND EQUIPMENT PER MANUFACTURER.

REDESIGN AND REMODEL EXISTING POLICE SPACE FOR FUTURE PURPOSE.

REDESIGN AND REMODEL ALL EXISTING PUBLIC AND STAFF AREAS ON THE 1ST AND 3RD FLOORS.

REPLACE ALL EXISTING ROOF FRAMING, INSTALL FULLY ADHERED TAPERED INSULATION, WITH MINIMUM 1/4" PER FOOT SLOPE TO DRAIN. INSTALL NEW METAL STANDING SEAM PARAPET CAP FLASHING AT PARAPET PERIMETER. PROPERLY INTEGRATE WATERPROOFING TRANSITIONS AT ALL DECK TO WALL LOCATIONS, CORNERS, THRESHOLDS, AND DECK DRAINS PER MANUFACTURER. INSTALL NEW 3/4" CDX PLYWOOD TO MATCH EXISTING. INSTALL NEW WATERPROOF MEMBRANE, DRAINAGE MAT, PROTECTION BOARD, AND ALL MANUFACTURER REQUIRED FLASHINGS AND ACCESSORIES.

INSTALLATION INSTRUCTIONS. INSTALL NEW TRAFFIC COATING PER MANUFACTURER INSTALLATION INSTRUCTIONS WITH ALL MANUFACTURER REQUIRED FLASHING AND ACCESSORIES.

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INSTALLATION INSTRUCTIONS. INSTALL NEW TRAFFIC COATING PER MANUFACTURER INSTALLATION INSTRUCTIONS WITH ALL MANUFACTURER REQUIRED FLASHING AND ACCESSORIES.
- REMOVE ALL EXISTING 100% INTERIOR LIGHT FIXTURES AND SIGNAGE DAMAGED DURING CONSTRUCTION. DISPOSE OF ALL MATERIALS LEGALLY. REMOVE AND STORE ALL LIGHT FIXTURES AND SIGNAGE; STORE DURING CONSTRUCTION AND REINSTALL. REPLACE ALL FIXTURES AND SIGNAGE Damaged during Construction.

- REMOVE 100% OF ALL WINDOWS, STOREFRONT SYSTEMS, GLASS BLOCKS, EXTERIOR GLAZED CANOPIES, RADIUS WINDOWS, AND EXTERIOR SWING DOORS. PROPERLY DISPOSE OF ALL MATERIALS PER LOCAL AHJ REQUIREMENTS. INSTALL NEW ALUMINUM STOREFRONT WINDOWS AND DOORS TO MATCH EXISTING SIZES AND LOCATIONS. INSTALL NEW RADIUS STOREFRONT WINDOWS TO MATCH EXISTING WHERE OCCURS. REMOVE 100% OF ALL WINDOWS, STOREFRONT SYSTEMS, GLASS BLOCKS, EXTERIOR GLAZED CANOPIES, RADIUS WINDOWS, AND EXTERIOR SWING DOORS. PROPERLY DISPOSE OF ALL MATERIALS PER LOCAL AHJ REQUIREMENTS.

- INSTALL NEW CONTINUOUS METAL BACK ANGLE AT ALL WINDOW SILLS, PROPERLY INTEGRATED WITH WRB PER MANUFACTURER’S CURRENT INSTALLATION INSTRUCTIONS.

- INSTALL NEW CURTAIN WALL GLAZING SYSTEM AT EXISTING GLASS BLOCK LOCATIONS. INSTALL NEW HOLLOW METAL SWING DOORS TO MATCH EXISTING, AS OCCURS. PROVIDE FULLY SOLDERED WEATHER TIGHT installations.

- PROVIDE CONTINUOUS SEALANT BED BELOW ALL SILL PAN FLASHING. PROVIDE CONTINUOUS METAL HEAD FLASHING WITH UPTURNED END DAMS AT ALL WINDOW AND DOOR OPENINGS; PROPERLY INTEGRATE ALL SILL PANS UNDER NEW STOREFRONT AND CURTAIN WALL SYSTEMS. PROPERLY INTEGRATE NEW SILL PANS WITH WEATHER RESISTIVE BARRIER SYSTEM PER MANUFACTURER CURRENT INSTALLATION INSTRUCTIONS.

- INSTALL NEW METAL PANEL CLADDING SYSTEM PER MANUFACTURER CURRENT INSTALLATION INSTRUCTIONS OVER VERTICAL METAL HAT CHANNEL FURRING, WITH CONTINUOUS DRAINAGE PLANE.

- INSTALL NEW LIQUID APPLIED WEATHER RESISTIVE BARRIER PER MANUFACTURER CURRENT INSTRUCTIONS WITH ALL MANUFACTURER REQUIRED FLASHING AND ACCESSORIES.

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- INSTALL NEW METAL ROOF SCREEN, AND STRUCTURAL ROOF SCREEN SUPPORTS TO MATCH EXISTING HEIGHT AND LOCATIONS. INSTALL NEW PEA GRAVEL WHERE OCCURS.

- DEMO EXISTING ROOF SCREEN AND PROPERLY DISPOSE. DEMO EXISTING ROOF MEMBRANE AT ALL ROOFS, ROOF DECK, PARAPET CAP FLASHING, METAL SKIRTING, AND ALL RELATED FLASHING AND ACCESSORIES (ALL ROOFS).

- PROVIDE CONTINUOUS SEALANT BED BELOW ALL SILL PAN FLASHING. PROVIDE CONTINUOUS METAL HEAD FLASHING WITH UPTURNED END DAMS AT ALL WINDOW AND DOOR OPENINGS; PROPERLY INTEGRATE ALL SILL PANS UNDER NEW STOREFRONT AND CURTAIN WALL SYSTEMS. PROPERLY INTEGRATE NEW SILL PANS WITH WEATHER RESISTIVE BARRIER SYSTEM PER MANUFACTURER CURRENT INSTALLATION INSTRUCTIONS.

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- INSTALL NEW LIQUID APPLIED WEATHER RESISTIVE BARRIER PER MANUFACTURER CURRENT INSTRUCTIONS WITH ALL MANUFACTURER REQUIRED FLASHING AND ACCESSORIES.
Lake Oswego City Hall - Project Cost Summary Comparison

### Consultants Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>A Cut Above</th>
<th>M. Revised Soft Costs</th>
<th>M. Construction Cost Review</th>
<th>M. Per SF ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Hard Cost</strong></td>
<td>$3,739,755.00</td>
<td>$3,739,755.00</td>
<td>$4,663,031.77</td>
<td>$4,800,000.00</td>
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<tr>
<td><strong>Pretax Operating Costs</strong></td>
<td>$812,025.00</td>
<td>$812,025.00</td>
<td>$919,291.26</td>
<td>$960,745.00</td>
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<tr>
<td><strong>Netted Hard Cost</strong></td>
<td>$2,927,730.00</td>
<td>$2,927,730.00</td>
<td>$3,743,740.51</td>
<td>$3,840,255.00</td>
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<tr>
<td><strong>Assumed construction cost basis</strong></td>
<td>$2,927,730.00</td>
<td>$2,927,730.00</td>
<td>$3,743,740.51</td>
<td>$3,840,255.00</td>
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<tr>
<td><strong>M. Per SF ROM</strong></td>
<td>$1,075.68</td>
<td>$1,114.476</td>
<td>$1,263,882.94</td>
<td>$1,263,882.94</td>
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<td><strong>Building Size</strong></td>
<td>40,000 sf</td>
<td>40,000 sf</td>
<td>40,000 sf</td>
<td>40,000 sf</td>
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<tr>
<td><strong>Contingency</strong></td>
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<td>$99,524.15</td>
<td>$1,043,777.45</td>
<td>$1,043,777.45</td>
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<tr>
<td><strong>Total Construction Costs</strong></td>
<td>$4,827,286.75</td>
<td>$4,827,286.75</td>
<td>$4,937,518.96</td>
<td>$5,103,032.39</td>
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### Owner Costs

<table>
<thead>
<tr>
<th>Description</th>
<th>$1,000,000.00</th>
<th>$1,263,675.00</th>
<th>$1,365,650.98</th>
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<tbody>
<tr>
<td><strong>Land Acquisition</strong></td>
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<td>$0.00</td>
<td>$0.00</td>
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<tr>
<td><strong>Relocation of Over Head Power Lines to Underground</strong></td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
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<tr>
<td><strong>Utilities, Furniture &amp; Equipment (FF&amp;E)</strong></td>
<td>$0.00</td>
<td>$516,000.00</td>
<td>$516,000.00</td>
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<tr>
<td><strong>Appliances</strong></td>
<td>$30,000.00</td>
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<tr>
<td><strong>Lockers/Storage</strong></td>
<td>$0.00</td>
<td>$300,000.00</td>
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<tr>
<td><strong>Shelving</strong></td>
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<td>$0.00</td>
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<tr>
<td><strong>Furniture</strong></td>
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<td>$0.00</td>
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<tr>
<td><strong>Telephone/Data/AV/Security Equipment</strong></td>
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<td><strong>LEED Registration</strong></td>
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<td><strong>Mold Abatement</strong></td>
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<td><strong>Temporary Facilities</strong></td>
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<td><strong>1% For Art</strong></td>
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<td><strong>Permits</strong></td>
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<td>$18,566.00</td>
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<tr>
<td><strong>专项Use</strong></td>
<td>$6,600.00</td>
<td>$6,600.00</td>
<td>$6,600.00</td>
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<tr>
<td><strong>Radio Antenna</strong></td>
<td>$0.00</td>
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<tr>
<td><strong>Waste Fees</strong></td>
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<tr>
<td><strong>Subtotal - Owner Costs</strong></td>
<td>$36,000.00</td>
<td>$36,000.00</td>
<td>$36,000.00</td>
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<tr>
<td><strong>Owner’s Project Manager</strong></td>
<td>$50,000.00</td>
<td>$50,000.00</td>
<td>$50,000.00</td>
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<tr>
<td><strong>Contingency</strong></td>
<td>$500,000.00</td>
<td>$500,000.00</td>
<td>$500,000.00</td>
<td>$500,000.00</td>
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<tr>
<td><strong>Total Owner Costs</strong></td>
<td>$58,994.00</td>
<td>$58,994.00</td>
<td>$58,994.00</td>
<td>$58,994.00</td>
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</tbody>
</table>

### Total Project Cost

<table>
<thead>
<tr>
<th>Description</th>
<th>$5,611,937.00</th>
<th>$9,301,090.57</th>
<th>$11,199,395.91</th>
<th>$14,591,728.43</th>
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</thead>
<tbody>
<tr>
<td><strong>Total Pre-Design</strong></td>
<td>$5,611,937.00</td>
<td>$9,301,090.57</td>
<td>$11,199,395.91</td>
<td>$14,591,728.43</td>
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### Approved Cost Delta

<table>
<thead>
<tr>
<th>Description</th>
<th>$0.00</th>
<th>($3,689,153.57)</th>
<th>($5,587,458.91)</th>
<th>($8,979,791.43)</th>
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</thead>
</table>
## Building Envelope Hard Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>A Cut Above</th>
<th>M. Cost Review</th>
<th>Total 01/27/17</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exterior Wall Assemblies</strong></td>
<td>$2,442,160.00</td>
<td>$2,582,030.00</td>
<td>$2,582,030.00</td>
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<tr>
<td>Replace 60-100% of Steel Studs *</td>
<td>$64,870.00</td>
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<tr>
<td>Install new EIFS*</td>
<td>$75,000.00</td>
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<tr>
<td><strong>Window &amp; Doors</strong></td>
<td>$383,223.00</td>
<td>$508,888.02</td>
<td>$508,888.02</td>
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<tr>
<td>Hollow Metal/Storefront *</td>
<td></td>
<td>$125,665.02</td>
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<tr>
<td><strong>Roof Assemblies</strong></td>
<td>$394,615.00</td>
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<td>$630,001.75</td>
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<tr>
<td>Replace 25% of Structural Joists **</td>
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<td>$4,879.43</td>
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<td>Install T&amp;G sheathing *</td>
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<td>$91,190.72</td>
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<tr>
<td>Install New Mechanical Roof Screen***</td>
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<td>$139,316.60</td>
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<td><strong>Interior Repairs</strong></td>
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<td>$457,985.66</td>
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<tr>
<td>Replace 100% of Exterior Perimeter Gypsum wall Sheathing *</td>
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<td>$59,562.34</td>
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<tr>
<td>Install New Wall Base at 100% of Perimeter Walls*</td>
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<td>$6,753.60</td>
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<tr>
<td>Install New Vapor Barrier at 100% of Perimeter Walls*</td>
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<td>$38,053.72</td>
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<tr>
<td><strong>Electrical, Plumbing, HVAC, Alarm, Sprinkler, Other Specialty Trades</strong></td>
<td>$136,141.00</td>
<td>$226,378.34</td>
<td>$226,378.34</td>
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<tr>
<td>Seismic Upgrades</td>
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<tr>
<td>Concrete Repairs</td>
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<td>$10,000.00</td>
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<tr>
<td>Crane to lift HVAC Equipment for roof flashing</td>
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<tr>
<td>Repair/Replacement of Interior Floor Coverings</td>
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<td>$19,698.00</td>
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<td>HVAC System Repair</td>
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<tr>
<td>Traffic Coating over Concrete in Parking Garage</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Construction Hard Cost</strong></td>
<td>$3,739,755.00</td>
<td>$4,463,031.77</td>
<td>$4,463,031.77</td>
<td></td>
</tr>
</tbody>
</table>

### Notes

1. Assumes like with like replacement at building perimeter
2. See Cost Documents for additional information
3. Will be priced as a Voluntary Upgrade
4. Will be priced as a Voluntary Upgrade or Full Seismic Upgrade
5. Existing building cannot support Stucco

* See A Cut Above Estimate for specified scope
** Not Included in A Cut Above specified scope
*** Demo Cost Not Included
**** Undefined in Estimate
***** Only 20% Included in A Cut Above Estimate

\[\text{Cost} = \frac{\text{Total Construction Hard Cost}}{\text{Square Footage}}\]

- A Cut Above: $93.49 /sf
- M. Cost Review: $111.58 /sf