kpff Consulting Engineers

SEISMIC STUDY OF EXISTING SCHOOL FACILITIES

Portland Public Schools **December 7, 2009**

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SEISMIC **STUDY OF EXISTING SCHOOL FACILITIES**

Portland Public Schools

Executive Summary

School facilities for Portland Public Schools, with a few exceptions, were constructed prior to recognition of the need for seismic-resistant design. The infrequency of large earthquakes in Oregon during recorded history led to much less attention to seismic design prior to the 1970's than in more seismically active areas such as California. Recent studies have shown that, although infrequent, very large earthquakes with long durations occurred in Oregon many times previously during our geologic history. The impact of one of these large earthquakes on school facilities could be catastrophic.

The current project is a continuation of an ongoing effort that began in 1995 to seismically upgrade District facilities. This project uses current seismic methodology to assist planning for future facility improvements. The current methodologies, which have come into widespread use within the past several years, include ASCE (American Society of Civil Engineers) 31-03, *Seismic Evaluation of Buildings,* which is used to evaluate existing buildings and ASCE 41-06, *Seismic Rehabilitation of Existing Buildings,* which is used in the design of retrofit work.

To determine the extent of work and related cost for the remaining seismic work, buildings from 12 school campuses were chosen as a representative sample to study. These buildings represent a mix of construction types which occur throughout the District. Each of the buildings was evaluated using ASCE 31-03 to determine seismic deficiencies and ASCE 41-06 to develop a preliminary rehabilitation scheme for each building. A probable cost of construction for these schemes were then determined. The seismic rehabilitation work includes both structural and non-structural elements (such as clay tile walls, brick veneer, and ceilings). Lifelines such as electrical, water, and natural gas supply are not considered.

For the 12 campuses, an approximate cost was determined for two options: (a) for the seismic retrofit plus removal and replacement of finishes, and (b) for the cost of the seismic work only as part of a larger renovation. The cost of the seismic work only applies to seismic upgrades done in conjunction with a comprehensive remodel of the building where existing finishes would be removed and replaced. The approximate costs per square foot determined for the 12 campuses were projected to similar campuses, based on construction type, to arrive at approximate costs per square foot for the entire inventory of buildings. The result for all buildings is an approximate cost of $50 per square foot for seismic rehabilitation plus removal and replacement of finishes and approximately $25 per square foot for seismic work only. These approximate costs are total project costs and include permits, testing, special inspections, contingency and soft costs. Seismic rehabilitation work since 1997 has been based on the criteria of FEMA 178, National

Earthquake Hazards Reduction Program (NEHRP) "Handbook for the Seismic Evaluation of Existing Buildings." The 1995 Facilities Capital Improvements (Bond) Program allocated $39 million (one-fifth of the total program) for seismic improvements, and this increased to approximately $47 million expended, because of interest gains. This resulted in partial seismic upgrades at 53 schools and two other facilities, and as part of re-roofing at 15 schools, with emphasis on safe exiting for students and staff. Although this work improved the seismic performance of these facilities, much remains to be done.

Introduction and Scope

Facilities within the Portland Public School District include 84 school campuses plus 21 other facilities, many of which have multiple buildings, with a total of approximately 9 million square feet. Almost all of the schools were constructed prior to 1960, and modern building codes, and included little consideration for resistance to seismic forces. Construction types vary widely between schools and include concrete, masonry, clay tile, steel and wood materials. Seismic forces were not considered in the original design of the majority of the schools.

Portland Public Schools retained KPFF Consulting Engineers to update the seismic evaluations of the schools and other facilities and to determine probable costs for seismic rehabilitation based on current seismic criteria. A representative sampling of 12 school campuses were evaluated to determine preliminary seismic rehabilitation schemes. From the evaluations for these 12 school campuses and the resulting strengthening schemes an overall district-wide approximate cost for seismic improvements was developed.

The work included a review of previous seismic evaluations and cost estimates for remaining seismic rehabilitation work as well as improvements that have been completed since 1995. For past work, a rating system was developed to target the most hazardous schools for seismic improvements. These seismic improvements focused on preventing building collapse and allowing safe exiting after an earthquake. New lateral force resisting elements such as shear walls and roof diaphragms were only added in a small percentage of the schools. Some roof diaphragm work has been completed. Note that a complete lateral system consists of horizontal elements (roof and floor diaphragms) and vertical elements (shear walls or braced frames).

Observations, analyses, and conclusions contained in this report reflect KPFF's best engineering judgment. The evaluations included limited field reconnaissance to observe the general physical status of several of the facilities in an attempt to confirm the structural information shown on the existing drawings. In most cases, building finishes conceal structural elements. No testing or demolition of finishes to expose the existing structural elements was conducted to determine their material properties. Concealed problems with the construction of the buildings may exist that cannot be revealed through these observations.

Current Study Conclusions and Costs

The construction types for the schools vary widely but include unreinforced masonry (URM), lightly reinforced concrete walls (LRCW), reinforced concrete, steel, reinforced masonry and wood. Since an exhaustive study of all schools was beyond the scope of this study, buildings from a representative group of 12 school campuses were seismically evaluated utilizing ASCE 31-06 and had preliminary rehabilitation schemes developed utilizing ASCE 41-06 for cost estimating. The buildings on the 12 campuses include some of each type of construction present throughout the District and were chosen as a representative sample that would capture the spectrum of seismic rehabilitation work necessary. See Current Seismic Studies and Philosophy for a discussion on ASCE-31 and 41.

The work identified for costing includes seismic rehabilitation of both structural and non-structural elements. Non-structural elements include items that are not part of the structural frame but could pose a falling hazard in an earthquake, such as clay tile walls, brick veneer, chimneys, ceilings, and mechanical, electrical and plumbing elements. Seismic work related to brick veneer was limited to that over the building exits.

Buildings at the following 12 school campuses were included in the study:

1. Ainsworth K-5
2. Binnsmead/ 6-8
3. Chapman K-5
4. Cleveland High School
5. Creston K-7
6. Grant High School
7. Humboldt PK-7
8. Jackson 6-8
9. Lane 6-8
10. Llewellyn K-5
11. Richmond PK-5
12. Wilcox PPS Programs

Approximate costs were determined for two scenarios; (a) costs for the seismic rehabilitation plus removal and replacement of finishes, and (b) costs of the seismic rehabilitation only. The costs for seismic rehabilitation only would be valid for work in buildings that are undergoing a complete renovation where finishes throughout would be demolished and replaced. Approximate costs from the 12 campuses were assigned to other campuses of similar construction to determine an approximate cost for all facilities within the District. A summary of these approximate costs for each facility is contained within the Appendix. The District-wide approximate cost estimate for seismic rehabilitation and removal and replacement of finishes is $50 per square foot. The District-wide approximate cost for seismic rehabilitation only is $24 per square foot. Costs are total project costs which include total construction cost, 20% construction contingency, an allowance of 6% for permits, testing and special inspections, plus 30% for soft costs. Soft costs include the following:

- A&E Fees
  Sub-consultants
  Historic Review
  Value Engineering
- Third Party Consultants
  Geotechnical Survey
  Constructability Review
- Construction Manager
- Project Manager
- Finance and Accounting
- Program Management and Assessment
- Public Involvement
- Program Reserve

Future seismic rehabilitation work will generally be voluntary, but there are certain triggers that could require mandatory work. Chapter 24.85 of the City of Portland Building Code entitled "Seismic Design Requirements for Existing Buildings" includes limitations that could trigger seismic work for additions and alterations as well as for unreinforced masonry (URM) buildings. Additions and alterations which increase the seismic forces in any structural element by more than 5% require that element to be shown to comply with current code or be strengthened to current code. For URM buildings, re-roofing requires the addition of wall ties and bracing of parapets. Renovations of URM buildings exceeding approximately $45 per square foot for single story buildings or approximately $35 per square foot for multi-story buildings will trigger seismic strengthening of the entire building.

We recommend that future seismic rehabilitation work comply with ASCE 41-06 or with current seismic code requirements. The work completed for this project is preliminary in nature with the intent to determine a likely extent of work that was used to develop probable costs of seismic rehabilitation to current seismic criteria. Although the preliminary schemes developed for the 12 campuses can be used as a starting point, further analysis and development to arrive at a final seismic rehabilitation scheme for buildings on these campuses is required. Consideration for architectural, mechanical, electrical and plumbing items was not part of this project and will need to be considered in developing final seismic rehabilitation schemes. In addition, selective demolition and testing will be needed in many cases to supplement existing drawing information.

As part of this project, GeoDesign, Inc. prepared geologic hazards evaluation consistent with ASCE 41-06 for each of the school campuses. The geologic site hazards identified in ASCE 41-06 and included in the evaluation are surface fault rupture, liquefaction, differential compaction, slope failure, and flooding or inundation. The evaluation was based on available hazard maps. The evaluation results are included in the Appendix. Based on the study results, the risk from geological hazards is low in most cases and will not likely impact future seismic rehabilitation work. However, in the 14 cases where the risk is low-to-moderate, or the 5 cases where the risk is moderate-to-high, consideration should be given to the potential hazard and the impact on seismic rehabilitation of those school campuses.

Current Seismic Studies and Philosophy

The current seismic studies that were performed as part of this effort were based on the following documents:

ASCE 31-03, *Seismic Evaluation of Existing Buildings*
ASCE 41-06, *Seismic Rehabilitation of Existing Buildings*

These documents are meant to be used together in the rehabilitation process, with the first step being an evaluation using ASCE 31-03 to determine deficiencies, followed by a rehabilitation scheme being developed (if necessary) using ASCE 41-06. These documents were developed specifically to address the evaluation and retrofit of existing buildings because current building code does not address many existing materials and types of construction. Because ASCE 31-03 is only meant to be used as an evaluation tool, it is slightly more lenient than ASCE 41-06 so that buildings that are only slightly overstressed would not trigger an upgrade. If a building is determined to have deficiencies per ASCE 31-03, then the upgrade scheme is developed using the more rigorous requirements of ASCE 41-06.

In order to better understand the design criteria that were used, KPFF believes a brief discussion of current seismic design philosophy is beneficial. Current seismic design is based on the idea that it is not practical to prevent a building from being damaged during a seismic event. Therefore, the goal is to limit the damage to the elements of the building so that the building does not lose its load resisting capacity and risk a collapse. It should be noted that after a design level earthquake, the building may be significantly damaged, even to the point where it cannot be repaired. However, the risk to the life safety of the building occupants is relatively low. An analogy to this concept is the crumple zones and bumpers on modern cars. Because it is impractical to design a car to withstand the impact of a significant collision without damage, the crumple zones are added to dissipate energy and lessen the impact for the car's occupants. This is similar to how one designs the elements of the lateral force resisting system of a building to yield and dissipate energy such that the impact of an earthquake on the building is lessened.

Applying ASCE 31-03 and ASCE 41-06 to develop the upgrade schemes has several advantages. Primarily, ASCE 41-06 addresses existing materials and types of construction that the current building code does not address. This allows one to take advantage of existing structural elements that the current building code would not, which can significantly reduce the scope of the seismic upgrade work. Additionally, ASCE 41-06 is a performance based approach so the seismic hazard (i.e. how large an earthquake is considered) and building performance (i.e. how much damage is acceptable) can be targeted to the owner's needs This provides additional flexibility to the owner in case they want a building that either exceeds the requirements of the building code or is not fully code compliant.

For these evaluations, based on discussion with the District, the performance goal designated by ASCE-41-06, as the Basic Safety Objective (BSO) was used. The BSO is meant to provide an equivalent level of life safety for the building occupants as a new building is built to current code. The BSO is a dual performance goal that meets the Collapse Prevention Performance Level for the Basic Safety Earthquake 2, and the Life Safety Performance Level for the Basic Safety Earthquake 1. These terms are defined as follows and a graphical representation of these performance levels is shown on the following page:

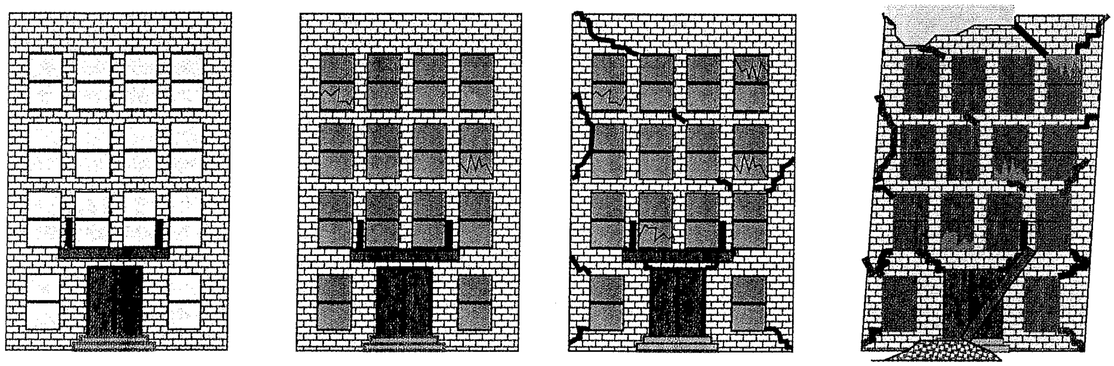
<u>Collapse Prevention Performance Level:</u> the post-earthquake damage is so significant that the building is on the verge of partial or total collapse. Substantial damage to the structure has occurred, potentially including significant degradation in the stiffness and strength of the lateral-force-resisting system, large permanent lateral deformation of the structure, and (to a limited extent) degradation in vertical load carrying capacity. However, all significant components of the gravity load resisting system must continue to carry their gravity loads. Significant risk of injury due to falling hazards from structural debris may exist. The structure may not be technically practical to repair and is not safe to reoccupy.

<u>Life Safety Performance Level:</u> the post-earthquake damage to the structure is significant, but some margin against either partial or total structural collapse remains. Some structural elements and components are severely damaged but this has not resulted in large falling debris hazards, either inside or outside the building. Injuries may occur during the earthquake; however the overall risk of life threatening injury as a result of structural damage is expected to be low. It should be possible to repair the structure; however for economic reasons this may not be practical. Although the damaged structure is not an imminent collapse risk, it would be prudent to implement structural repairs or install temporary bracing prior to reoccupying the building.

<u>Immediate Occupancy Performance Level:</u> the post earthquake damage to the structure is light. There is no permanent building drift. The structure maintains most of its original strength and stiffness. The risk to life threatening injury from structural damage is very low. Some minor repairs may be appropriate, but are not required for reoccupancy.

<u>Operational Occupancy Performance Level:</u> the post earthquake damage to the structure is very light. There is no permanent building drift. The structure maintains its original strength and stiffness. There is very little damage. The backup building services maintain function.

It should be noted, that Immediate Occupancy and Operational Performance Levels are very costly and typically not practical for schools and even less practical for renovations of existing schools.



Graphic illustration of Operational, Immediate Occupancy, Life-Safety, and Collapse Prevention Performance Levels. (Courtesy of R. Hamburger)

Basic Safety Earthquake 2: the seismic ground motions associated with an earthquake that has a probability of exceedance of 2% in 50 years (i.e. an event with a return period of approximately 2,500 years). This is also known as the Maximum Considered Earthquake (MCE) or the largest earthquake that is believed to be possible at the site. This event is what could be referred to as "the big one", or the Cascadia Subduction Zone event off the coast of Oregon.

Basic Safety Earthquake 1: the seismic ground motions associated with an earthquake that has a probability of exceedance of 10% in 50 years (i.e. an event with a return period of approximately 500 years). This is similar to the design level earthquake used in current building codes. This event is the local crustal earthquakes most familiar to those who have lived in the northwest for awhile.

Comparison of Previous Work with Current Approach

Seismic evaluations completed since 1995 were based on FEMA 178, NEHRP "Handbook for the Seismic Evaluation of Existing Buildings." Subsequently FEMA 178 was replaced by FEMA 310 and ASCE 31-03. The most significant deficiency for most buildings in the District is the lack of a viable lateral force resisting system. Seismic improvements completed to date have resulted in an improvement in expected seismic performance, but generally do not fully meet current earthquake design standards.

Previous Seismic Studies and Philosophy

Code and Project History Summary

Consideration of seismic forces for building design has a relatively short history in Oregon. The City of Portland code included relatively small seismic forces in 1956 which were typically less than wind forces. In 1964 the City adopted the Uniform Building code. Prior to the 1970's there was no state building code to prescribe seismic design considerations.

With the adoption of the 1994 Uniform Building Code by the State of Oregon, seismic forces increased 50% from previous codes because of a change in seismic zones for the Willamette Valley from Zone 2B to Zone 3. That change prompted the City of Portland to re-evaluate the seismic provisions of its Building Code which included a statement that, if a building's strength to resist forces, including seismic, was less than 66% of current code, it was considered a dangerous building. As a result of the seismic zone change a majority of the city's building were considered "dangerous."

A taskforce consisting of engineers, architects, attorneys, building owners, city officials, a PPS representative, and other interested parties convened to determine a course of action. The result of that effort was a change in the dangerous building definition to exclude seismic forces and a set of requirements titled Chapter 24.85 "Interim Seismic Design Requirements for Existing Buildings". Chapter 24.85 included requirements that unreinforced masonry buildings (URM) with roof replacements have the wall ties added and parapets braced, and those undergoing renovations exceeding $15 per square foot be seismically upgraded.

At the same time Portland Public Schools, realizing a portion of their building inventory included URM buildings contracted with KPFF Consulting Engineers and other firms to conduct FEMA 178 evaluations of these buildings to determine probable costs for a bond measure to include seismic rehabilitation.

After the 1995 bond measure was passed a project management firm was hired along with three teams of architects, engineers (including KPFF), and contractors. Each team was given five schools to evaluate and upgrade. The intent was to mitigate the most serious deficiencies. This work was expanded to include additional architects and engineers to address more schools and continues most recently with the re-roofing and related seismic rehabilitation work in the summer of 2009.

Seismic Upgrade Philosophy

The original FEMA 178 evaluations were conducted to determine seismic deficiencies in schools that were believed to be the highest hazard. A rating system termed the Hazard Index was developed to identify facilities posing the highest seismic risk. Due to the limited funds available, it was decided to concentrate on improvements that would help prevent collapse and allow safe exiting. Where unreinforced masonry walls could not be strengthened, they were supplemented with steel framing to prevent collapse and allow safe exiting. Two examples of this are the A Wing of Benson High School and Creston Elementary School. In addition, parapets were braced over doorways to prevent falling hazards for students and staff exiting.

The current approach of "collapse prevention and safe exiting" in KPFF's opinion, is not sufficient to protect the life safety of building occupants during a design earthquake. Our recommendation is to use the methodology of ASCE 41-06 or current code seismic provisions to develop rehabilitation schemes. This is a significant change in seismic upgrade philosophy. Most buildings will require the addition of lateral force resisting systems. In concrete and unreinforced masonry buildings, this will typically consist of new reinforced concrete shear walls, footings, and ties to roof and floor levels uniformly distributed throughout the building in both directions. The work for each school may be done all at once or be phased as repairs and remodels allow. The goal will be to eventually have a code equivalent lateral force resisting system in every building.

Seismic Hazard Ranking Summary

The James G. Pierson, Inc. summary of the hazard ranking system in their 2002-03 report (updated in December 2005) is a detailed description of the processes used to rank schools. The ranking system evolved from the original efforts following the 1995 bond measure to assign a hazard ranking to the schools, called the Hazard Index, to the Structural Hazard Score developed by Pierson Engineers. The Hazard Index was based on the demand to capacity ratio (DCR), number of occupants, hours of occupancy, material, and building area. The DCR is a ratio of required strength versus the actual strength for a building. The equation was as follows:

Hazard Index (HI) = DCR x Occupants x Hours x Material Factor x 100 / Building Area

Approximate Costs

The previous estimate for seismic work alone, based on the James G. Pierson, Inc. summary from October 2008, is approximately $6 per square foot including soft costs and applying the present policy of collapse prevention and safe exiting. This is the total seismic cost for all school facilities divided by the total square footage.

The District-wide cost of the seismic work applying ASCE 41-06 standards is approximately $50 per square foot for seismic rehabilitation plus removal and replacement of finishes including soft costs. The District-wide cost for seismic work only without demolition and replacement of finishes is approximately $24 per square foot. These numbers are overall averages only, with actual costs dependent upon the type of construction.

Previous Seismic Rehabilitation Work

According to a compilation from PPS dated June 18, 2008, limited seismic rehabilitation work was accomplished in 63 schools. In addition, nine schools were reroofed this past summer. This work includes the addition of plywood, roof/wall ties and parapet bracing.

The previous seismic rehabilitation work has included bracing of unreinforced walls and partitions, adding new brick veneer anchors, chimney removal or bracing, unreinforced masonry parapet bracing, rehabilitation of floor and roof diaphragms, and some rehabilitation of the building lateral force resisting systems. Most of the work has been focused on retrofitting the greatest hazards for "collapse prevention and safe exiting" and has not resulted in complete seismic rehabilitation of any facilities based on the current criteria.

Conclusions and Recommendations

Seismic rehabilitation schemes for 12 school campuses were developed using current seismic criteria to determine approximate costs for the work. These costs were extrapolated to facilities throughout the District to determine an overall cost of the work. A District-wide cost for seismic rehabilitation including removal and replacement of finishes is approximately $50 per square foot. Cost for seismic rehabilitation as part of a larger renovation is approximately $24 per square foot. District wide totals for these two approaches are $422.6 million and $206.5 million respectively. Most seismic rehabilitation work will be on a voluntary basis, with the exception of unreinforced masonry buildings for which some circumstances trigger mandatory strengthening per the City of Portland. Renovations of URM buildings exceeding approximately $45 per square foot for single story buildings or approximately $35 per square foot for multi-story buildings will trigger seismic strengthening of the entire building.

For future work, although voluntary, we recommend that rehabilitation work utilize ASCE 41-06 or current code seismic provisions to determine the extent of work required. Both structural and non-structural elements should be included in the work. This approach, although much more expensive than the current approach, will achieve a more consistent and life safe condition for the building occupants.

The previous approach of "collapse prevention and safe exiting", in our opinion, is not sufficient to protect the life safety of building occupants during a design earthquake. Our recommendation is to use the methodology of ASCE 41-06 or current code seismic provisions to develop rehabilitation schemes. This is a significant change in seismic upgrade philosophy. Most buildings will require the addition of lateral force resisting systems. In concrete and unreinforced masonry buildings, this will typically consist of new reinforced concrete shear walls, footings, and ties to roof and floor levels uniformly distributed throughout the building in both directions. In many schools, where floor and roof diaphragms are not sufficient to transfer lateral forces to the walls, the diaphragms will also need strengthening. The work for each school may be done all at once or be phased as repairs and remodels allow. The goal will be to eventually have a code equivalent lateral force resisting system in every building.

All school renovation work is to comply with current City of Portland Building Code requirements as they relate to seismic strengthening to the extent allowed by resources.

ASCE/SEI 31-03 'Seismic Evaluation of Existing Buildings" and ASCE/SEI 41-06 "Seismic Rehabilitation of Existing Buildings" are to be considered in identifying seismic upgrades at schools and other PPS facilities and estimating projected costs.

New replacement schools are to comply with current code requirement including seismic provisions. Existing schools to receive full modernization are to fully comply with the current seismic code or with the Basic Safety Objective per ASCE/SEI 41-06 "Seismic Rehabilitation of Existing Buildings" as they apply to those components, including non-structural elements.

Existing buildings receiving re-roofing or other retrofitting such as new elevators are to comply with the current seismic code with the Basic Safety Objective per ASCE/SEI 41-06 “Seismic Rehabilitation of Existing Buildings” as they apply to these components.

Consideration for architectural, mechanical, electrical and plumbing items was not part of this project and will need to be considered in developing final seismic rehabilitation schemes. In addition, selective demolition and testing will be needed in many cases to supplement existing drawing information.

Appendix

	School Name	Addition	Type	Floors	Year Built	Square Ft.	Seismic Work Done	Construction Type	Estimated Seismic Cost * $	Cost per SF	Updated Total Cost 2009	2009 Cost per sq. ft.	Seismic Only 2009	Seismic Only 2009 Cost per sq. ft.
	Ainsworth Elementary		Elementary	3	1912	55273	No	URM	768,000	13.89	4313602	78	2162659	39
	Binnsmead Middle School		Middle	1	1949	109059	No	Wood	279,000	2.56	2413956	22	600344	6
	Chapman Elementary		Elementary	3	1923	59969	Yes	URCW	694,000	11.57	3217187	54	1261438	21
	Cleveland High School		High	3	1928	251892	Yes	URCW	1,075,000	4.27	19647133	78	11580456	46
	Creston Elementary		Elementary	1	1948	70765	Yes	Wood	350,000	4.95	5330051	75	1645672	23
	Grant High School		High	2	1923	269350	Yes	URM	2,645,000	9.82	15303845	57	8137035	30
	Humboldt Elementary		Elementary	1	1959	42920	No	Wood	135,000	3.15	415805	10	199323	5
	Jackson Middle School		Middle	2	1966	247779	No	Concrete	0	0	11667281	47.09	5274197	21.29
	Lane Middle School		Middle	2	1927	87438	Yes	URCW	939,000	10.74	3963413	45	1648465	19
	Llewelyn Elementary		Elementary	2	1928	49755	No	URCW	648,000	13.02	5082512	102	2729175	55
	Richmond Elementary		Elementary	3	1908	77070	Yes	URCW / Wood	353,000	4.58		0	3137757	41
	Wilcox Elementary		Elementary	1	1959	19102	No	steel		0.00	440153	23	129730	7

	Average Construction Costs per Sq. Ft		
	Construction Type	Total Cost	Seismic Only
	URCW Schools	66	30
	Wood Schools	49	38
	URM Schools	35	13
	Concrete	78	39
	Steel	10	5

Notes: Cost for each construction type were based on averages of probable costs.

Creston is an anomoly because it's a wood school with high cost to replace or brace clay tile walls.
Cost for wood schools were reduced on the master spreadsheet to $20 and $8 per square foot for total and seismic only.

ASCE Eval	School Name	Type	Floors	Year Built	Square Ft.	Seismic Work Done	Construction Type	Additions	Average cost/sf for Seismic Retrofit by Construction Type	Total Cost for Seismic Retrofit by Construction Type	Cost/sf with Seismic Retrofit as Part of Larger Renovation	Total Cost with Seismic Retrofit as Part of Larger Renovation
N	Abernathy Elementary	K-5	2	1925	48438	No	LRCW	No	$ 70	$ 3,380,004	$ 36	$ 1,752,487
Y	Ainsworth Elementary	K-5	3	1912	55273	No	LRCW	Yes	$ 70	$ 3,856,950	$ 36	$ 1,999,777
Y	Alameda Elementary	K-5	2	1921	60840	No	Wood	Yes	$ 20	$ 1,216,800	$ 8	$ 486,720
N	Applegate Elementary	PPS Programs	1	1954	25202	No	Wood	Yes	$ 20	$ 504,040	$ 8	$ 201,616
N	Arleta Elementary	K-6	2	1929	76489	Yes	LRCW	Yes	$ 70	$ 5,337,402	$ 36	$ 2,767,372
N	Astor Elementary	K-6	1	1949	47360	Yes	Wood	Yes	$ 20	$ 947,200	$ 8	$ 378,880
N	Atkinson Elementary	K-5	1	1952	58057	No	Wood	Yes	$ 20	$ 1,161,140	$ 8	$ 464,456
N	Beach Elementary	PK-7	3	1928	66633	No	LRCW	Yes	$ 70	$ 4,649,651	$ 36	$ 2,410,782
N	Beaumont Middle School	6-8	3	1926	94431	No	LRCW	Yes	$ 70	$ 6,589,395	$ 36	$ 3,416,514
N	Benson High School	9-12	2	1916	402846	Yes	URM	Yes	$ 67	$ 27,163,906	$ 35	$ 13,966,671
N	Boise Elliot Elementary	PK-6	2	1926	61369	No	LRCW	Yes	$ 70	$ 4,282,329	$ 36	$ 2,209,284
N	Bridger Elementary	K-6	1	1951	43158	Yes	Wood	Yes	$ 20	$ 863,160	$ 8	$ 345,264
N	Bridlemile Elementary	K-5	1	1958	58057	Yes	Wood	Yes	$ 20	$ 1,161,140	$ 8	$ 464,456
N	Buckman Elementary	K-5	3	1921	82023	Yes	LRCW	No	$ 70	$ 5,723,565	$ 36	$ 2,967,592
N	Capitol Hill Elementary	K-5	2	1917	46379	Yes	Wood	Yes	$ 20	$ 927,580	$ 8	$ 371,032
Y	Chapman Elementary	K-5	3	1923	59969	Yes	LRCW	Yes	$ 70	$ 4,184,637	$ 36	$ 2,169,678
N	Chief Joseph Elementary	PK-5	1	1949	44412	No	Wood	Yes	$ 20	$ 888,240	$ 8	$ 355,296
N	Clarendon Elementary	closed 2007	1	1970	42958	No	Wood	No	$ 20	$ 859,160	$ 8	$ 343,664
Y	Cleveland High School	9-12	3	1928	251892	Yes	LRCW	Yes	$ 70	$ 17,577,024	$ 36	$ 9,113,453
N	Columbia Transportation & Student Facility	Other	2	1937	47346	No	Wood	Yes	$ 20	$ 946,920	$ 8	$ 378,768
N	Creative Science Elementary	K-5	1	1955	50595	Yes	Masonry	No	$ 36	$ 1,806,747	$ 11	$ 563,122
Y	Creston Elementary	K-6	1	1948	70765	Yes	Wood	No	$ 20	$ 1,415,300	$ 8	$ 566,120
N	Creston Elementary Annex	PPS Programs	1	1953	10175	Yes	Wood	No	$ 20	$ 203,500	$ 8	$ 81,400
N	DaVinci	6-8	3	1928	91876	Yes	LRCW	Yes	$ 70	$ 6,411,107	$ 36	$ 3,324,074
N	Duniway Elementary	K-5	2	1926	67492	No	LRCW	Yes	$ 70	$ 4,709,592	$ 36	$ 2,441,861
N	East Sylvan	6	2	1933	24986	No	Wood	No	$ 20	$ 499,720	$ 8	$ 199,888
N	Edwards Elementary	leased	1	1961	20502	No	Masonry	Yes	$ 36	$ 738,072	$ 11	$ 225,522
N	Faubion Elementary	PK-6	1	1950	57846	No	Wood	Yes	$ 20	$ 1,156,920	$ 8	$ 462,768
N	Fernwood Middle School	2-8	3	1911	73091	Yes	URM	Yes	$ 67	$ 4,928,526	$ 35	$ 2,534,065
N	Forest Park	K-5	2	1998	41898	No	Concrete	No	**			
N	Foster Holding	vacant	1	1963	11470	No	Wood	No	$ 20	$ 229,400	$ 8	$ 91,760
N	Franklin High School	9-12	3	1915	237027	Yes	URM	No	$ 67	$ 15,982,731	$ 35	$ 8,217,726
Y	George Middle School	6-8	1	1950	78713	No	URM	Yes	$ 67	$ 5,307,618	$ 35	$ 2,728,980
N	Glencoe Elementary	K-5	2	1923	63482	Yes	LRCW	Yes	$ 70	$ 4,429,774	$ 36	$ 2,296,779
Y	Grant High School	9-12	2	1923	269350	Yes	URM	Yes	$ 67	$ 18,162,271	$ 35	$ 9,338,365
N	Gray Middle School	6-8	2	1952	60624	No	Wood	Yes	$ 20	$ 1,212,480	$ 8	$ 484,992
N	Gregory Heights Middle School	K-8	2	1923	95438	Yes	LRCW	Yes	$ 70	$ 6,659,664	$ 36	$ 3,452,947
N	Grout Middle School	K-5	3	1927	65838	No	LRCW	No	$ 70	$ 4,594,176	$ 36	$ 2,382,019
Y	Harrison Park Middle School	6-8	1	1949	109059	No	Wood	Yes	$ 20	$ 2,181,180	$ 8	$ 872,472
N	Hayhurst Elementary	K-5	1	1954	56266	Yes	Wood	No	$ 20	$ 1,125,320	$ 8	$ 450,128

ASCE Eval	School Name	Type	Floors	Year Built	Square Ft.	Seismic Work Done	Construction Type	Additions	Average cost/sf for Seismic Retrofit by Construction Type	Total Cost for Seismic Retrofit by Construction Type	Cost/sf with Seismic Retrofit as Part of Larger Renovation	Total Cost with Seismic Retrofit as Part of Larger Renovation
N	Holladay Center	PPS Programs	1	1972	61457	No	Concrete	No	$ 47	$ 2,894,010	$ 21	$ 1,308,420
N	Hollyrood Elementary	K-2	1	1958	15701	No	Steel	No	$ 23	$ 361,751	$ 7	$ 106,610
Y	Hosford Middle School	6-8	3	1925	77050	No	LRCW	Yes	$ 70	$ 5,376,549	$ 36	$ 2,787,669
Y	Humboldt Elementary	PK-6	1	1959	42920	No	Wood	Yes	$ 20	$ 858,400	$ 8	$ 343,360
N	Irvington Elementary	K-6	2	1932	65285	Yes	LRCW	Yes	$ 70	$ 4,555,587	$ 36	$ 2,350,260
Y	Jackson Middle School	6-8	2	1966	247779	No	Concrete	No	$ 47	$ 11,667,913	$ 21	$ 5,275,215
N	James John Elementary	K-5	2	1929	63697	No	LRCW	Yes	$ 70	$ 4,444,777	$ 36	$ 2,304,557
N	Jefferson High School	9-12	4	1909	360911	Yes	URM	Yes	$ 67	$ 24,336,229	$ 35	$ 12,512,784
N	Kellogg Middle School	closed 2007	3	1913	94592	Yes	Concrete	Yes	$ 47	$ 4,454,337	$ 21	$ 2,013,864
N	Kelly Elementary	K-5	1	1952	82895	Yes	Wood	No	$ 20	$ 1,657,900	$ 8	$ 663,160
N	Kelly Learning Center	PPS Programs	1	1969	14651	No	Wood	No	$ 20	$ 293,020	$ 8	$ 117,208
Y	Kenton Elementary	leased	3	1913	48713	Yes	Concrete	Yes	$ 47	$ 2,293,895	$ 21	$ 1,037,100
N	King Elementary	PK-7	2	1925	88957	Yes	LRCW	Yes	$ 70	$ 6,207,419	$ 36	$ 3,218,464
Y	Lane Middle School	6-8	2	1927	87438	Yes	LRCW	Yes	$ 70	$ 6,101,424	$ 36	$ 3,163,507
N	Laurelhurst Elementary	K-5	2	1923	44251	No	LRCW	Yes	$ 70	$ 3,087,835	$ 36	$ 1,601,001
N	Lee Elementary	K-6	1	1953	73276	No	Wood	No	$ 20	$ 1,465,520	$ 8	$ 586,208
N	Lent Elementary	K-6	1	1949	74131	No	Wood	Yes	$ 20	$ 1,482,620	$ 8	$ 593,048
N	Lewis Elementary	K-5	1	1952	48380	No	Wood	Yes	$ 20	$ 967,600	$ 8	$ 387,040
N	Lincoln High School	9-12	3	1951	233293	Yes	Concrete	No	$ 47	$ 10,985,767	$ 21	$ 4,966,808
Y	Llewelyn Elementary	K-5	2	1928	49755	No	LRCW	No	$ 70	$ 3,471,904	$ 36	$ 1,800,136
N	Madison High School	9-12	3	1955	370112	Yes	Concrete	No	$ 47	$ 17,428,574	$ 21	$ 7,879,684
N	Maplewood Elementary	K-5	1	1948	34353	No	Wood	Yes	$ 20	$ 687,060	$ 8	$ 274,824
N	Markham Elementary	K-5	1	1951	82794	Yes	Wood	Yes	$ 20	$ 1,655,880	$ 8	$ 662,352
N	Marshall	9-12	3	1960	271427	No	Concrete	No	$ 47	$ 12,781,497	$ 21	$ 5,778,681
N	Marysville Elementary	K-6	1	1921	53490	Yes	Wood	No	$ 20	$ 1,069,800	$ 8	$ 427,920
N	Meek / Alliance	9-12	1	1953	32477	Yes	Wood	Yes	$ 20	$ 649,540	$ 8	$ 259,816
N	Metro Learning Center	K-12	3	1914	68135	No	LRCW	Yes	$ 70	$ 4,754,460	$ 36	$ 2,452,860
N	Mt. Tabor Middle School	6-8	1	1952	83076	Yes	Wood	Yes	$ 20	$ 1,661,520	$ 8	$ 664,608
N	Ockley Green	K-8	2	1925	69153	Yes	LRCW	Yes	$ 70	$ 4,825,496	$ 36	$ 2,489,508
N	Peninsula Elementary	K-6	1	1952	70151	No	Wood	Yes	$ 20	$ 1,403,020	$ 8	$ 561,208
N	Portsmouth / Clarendon	K-8	2	1928	75814	Yes	LRCW	Yes	$ 70	$ 5,290,301	$ 36	$ 2,729,304
N	Rice Elementary	PPS Programs	1	1955	16990	No	Wood	No	$ 20	$ 339,800	$ 8	$ 135,920
Y	Richmond Elementary	PK-5	3	1908	77070	Yes	Wood	Yes	$ 20	$ 1,541,400	$ 8	$ 616,560
N	Rieke Elementary	K-5	1	1961	30647	Yes	Steel	Yes	$ 23	$ 706,107	$ 7	$ 208,093
N	Rigler Elementary	K-6	2	1931	55312	Yes	LRCW	Yes	$ 70	$ 3,859,671	$ 36	$ 2,001,188
N	Roosevelt High School	9-12	2	1921	271306	Yes	URM	Yes	$ 67	$ 18,294,164	$ 35	$ 9,406,179
N	Rosa Parks	K-6	2	2006	46657	No	Wood	No	**			
N	Rose City Park Elementary	closed 2007	3	1912	72053	Yes	URM	No	$ 67	$ 4,858,534	$ 35	$ 2,498,078
Y	Sabin Elementary	PK-6	3	1928	66929	No	LRCW	Yes	$ 70	$ 4,670,306	$ 36	$ 2,421,491
N	Sacajewea Head Start	PPS Programs	1	1952	18751	No	Wood	No	$ 20	$ 375,020	$ 8	$ 150,008
N	Scott Elementary	K-6	1	1949	62681	No	Wood	Yes	$ 20	$ 1,253,620	$ 8	$ 501,448

ASCE Eval	School Name	Type	Floors	Year Built	Square Ft.	Seismic Work Done	Construction Type	Additions	Average cost/sf for Seismic Retrofit by Construction Type	Total Cost for Seismic Retrofit by Construction Type	Cost/sf with Seismic Retrofit as Part of Larger Renovation	Total Cost with Seismic Retrofit as Part of Larger Renovation
N	Sellwood Middle School	6-8	3	1914	86823	Yes	LRCW	Yes	$ 70	$ 6,058,509	$ 36	$ 3,141,256
N	Sitton Elementary	K-5	1	1949	58762	Yes	Wood	Yes	$ 20	$ 1,175,240	$ 8	$ 470,096
Y	Skyline Elementary	K-6	2	1939	37245	No	Wood	Yes	$ 20	$ 744,900	$ 8	$ 297,960
N	Smith Elementary	vacant	1	1958	38472	Yes	Masonry	Yes	$ 36	$ 1,384,992	$ 11	$ 423,192
N	Stephenson Elementary	K-5	1	1965	40539	No	Wood	Yes	$ 20	$ 810,780	$ 8	$ 324,312
N	Sunnyside Elementary	K-8	2	1925	54361	No	LRCW	Yes	$ 70	$ 3,793,311	$ 36	$ 1,966,781
N	Terwiliger School Facility	leased	1	1916	22150	No	Wood	Yes	$ 20	$ 443,000	$ 8	$ 177,200
N	Tubman Middle School	7-8	2	1954	94775	No	Concrete	Yes	$ 47	$ 4,462,955	$ 21	$ 2,017,760
N	Vernon Elementary	PK-7	3	1931	68091	Yes	LRCW	Yes	$ 70	$ 4,751,390	$ 35	$ 2,395,441
N	Vestal Elementary	K-6	2	1929	63382	Yes	LRCW	No	$ 70	$ 4,422,796	$ 36	$ 2,293,161
N	Washington HS	vacant	4	1923	91638	No	LRCW	No	$ 70	$ 6,394,500	$ 36	$ 3,315,463
Y	West Sylvan Middle School	7-8	2	1954	102209	No	Wood	Yes	$ 20	$ 2,044,180	$ 8	$ 817,672
N	Whitman Elementary	K-5	1	1954	68763	No	Wood	No	$ 20	$ 1,375,260	$ 8	$ 550,104
Y	Wilcox Elementary	PPS Programs	1	1959	19102	No	Steel	No	$ 23	$ 440,110	$ 7	$ 129,703
Y	Wilson High School	9-12	3	1954	326062	No	Concrete	No	$ 47	$ 15,354,260	$ 21	$ 6,941,860
N	Winterhaven @ Brooklyn	K-5	2	1930	38092	Yes	LRCW	Yes	$ 70	$ 2,658,060	$ 36	$ 1,340,077
N	Woodlawn Elementary	PK-6	1	1926	58608	Yes	LRCW	Yes	$ 70	$ 4,089,666	$ 36	$ 2,120,437
N	Woodmere Elementary	K-5	1	1954	55324	No	Wood	No	$ 20	$ 1,106,480	$ 8	$ 442,592
N	Woodstock Elementary	K-5	1	1910	69135	No	Wood	No	$ 20	$ 1,382,700	$ 8	$ 553,080
N	Youngson Elementary	PPS Programs	1	1955	32824	No	Wood	No	$ 20	$ 656,480	$ 8	$ 262,592
	Totals				8460492					$ 422,594,134		$ 206,515,635
	Cost per square foot									$ 50		$ 24

** Indicates design was done to current code. No seismic upgrade required

Note: Average cost per square foot values were determined for each construction type from estimates for the 12 representative schools. The average values are used in this spreadsheet.

ASCE Eval	School Name	Type	Floors	Year Built	Square Ft.	Seismic Work Done	Construction Type	Additions	Average cost/sf for Seismic Retrofit by Construction Type	Total Cost for Seismic Retrofit by Construction Type	Cost/sf with Seismic Retrofit as Part of Larger Renovation	Total Cost with Seismic Retrofit as Part of Larger Renovation

GEODESIGN INC

August 13, 2009

Portland Public Schools
501 North Dixon Street
Portland, OR 97227

Attention: Ms. Jen Sohm, Project Manager

Phase 1 Seismic Hazard Evaluation
Portland Public School Campuses
Portland, Oregon
GeoDesign Project: PortlandPS-5-01

INTRODUCTION

This letter summarizes our geologic hazards evaluation for 99 existing Portland Public School campuses in Portland, Oregon. Our work included a review of available geologic and seismic hazards maps to evaluate seismic geologic site hazards specified by the American Society of Civil Engineers (ASCE) 41-06 document for each of the school sites. Specifically, we reviewed the following information:

- "Geologic Map of the Portland Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon," Geological Map Series, GMS-75, Oregon Department of Geology and Mineral Industries (DOGAMI). (M.H. Beeson and others, 1991)
- "Geologic Map of the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon," Geological Map Series, GMS-59, DOGAMI. (M.H. Beeson and others, 1989)
- "Earthquake Hazard Geology maps of the Portland Metropolitan Area, Oregon: Text and Map Explanation," DOGAMI. (Madin, Ian P., 1990)
- "Earthquake Hazard Maps of the Portland Quadrangle, Multnomah and Washington Counties, Oregon, and Clark County, Washington," Geological Map Series, GMS-79. (Mabey, M.A. and others, 1993)
- "Relative Earthquake Hazard Map of the Portland Metro Region, Clackamas, Multnomah, and Washington Counties, Oregon," Interpretive Map Series, IMS-1, DOGAMI. (Mabey, Matthew A. and others, 1997)
- "Relative Earthquake Hazard Map of the Gladstone Quadrangle, Multnomah and Washington Counties, Oregon," Geologic Map Series, GMS-92, DOGAMI. (Mabey, Matthew A. and others, 1995)

- "Relative Earthquake Hazard Map of the Lake Oswego Quadrangle, Multnomah and Washington Counties, Oregon," Geologic Map Series, GMS-91, DOGAMI. (Mabey, Matthew A. and others, 1995)
- "Relative Earthquake Hazard Map of the Linnton Quadrangle, Multnomah and Washington Counties, Oregon," Geologic Map Series, GMS-104, DOGAMI. (Mabey, Matthew A. and others, 1996)
- "Relative Earthquake Hazard Map of the Mount Tabor Quadrangle, Multnomah County, Oregon, and Clark County, Washington," Geological Map Series, GMS-89, DOGAMI. (Mabey, Matthew A. and others, 1995)
- USGS, 2009, Quaternary fault and fold database for the United States, from USGS web site: http://earthquakes.usgs.gov/regional/qfaults/
- ASCE/SEI 41-06, "Seismic Rehabilitation of Existing Buildings"

SEISMIC HAZARDS

Each of the public school sites were evaluated as having high, moderate, or low risk of the following seismic hazard risks. Our evaluation is summarized in Table 1 (attached to this letter).

SURFACE FAULT RUPTURE

Our evaluation of the risk of surface fault rupture was based on review of existing faults mapped within 20 miles of the site. Our criteria for assessing this risk are based on the proximity of the particular campus to a mapped active fault. Generally, schools within a ¼ mile of a mapped fault were assessed as a low to moderate probability of fault rupture beneath the site. This is justified by the fact that mapped faults are based on limited deep borehole and geophysical data showing offset in the Troutdale and Columbia River Basalt in the Portland area. In addition, the evidence of fault offset of Holocene sediments is limited and not conclusive. The actual location of the mapped fault likely varies from the mapped location.

LIQUEFACTION

Liquefaction is a phenomenon caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles to near zero. The excessive buildup of pore water pressure results in the sudden loss of shear strength in a soil. Granular soils, which rely on interparticle friction for strength, are susceptible to liquefaction until the excess pore pressures can dissipate. In general, loose, saturated sand soils with low silt and clay contents are the most susceptible to liquefaction. Silty soils with low plasticity are moderately susceptible to liquefaction under relatively higher levels of ground shaking.

Based on the general information reviewed, and the anticipated soil and groundwater conditions at the site, we have assigned a general risk level on the attached spreadsheet for potential liquefaction. This is generally based on the risk assigned by the relative earthquake hazard maps.

DIFFERENTIAL COMPACTION

Differential compaction is defined as an earthquake-induced process in which foundation soils compact and the foundation settles in a non-uniform manner across the site. For the purpose of this study, we have assumed that this type of differential settlement is not related to liquefaction.

Differential liquefaction settlement is discussed above. The type of settlement discussed here is most prevalent in deep deposits of clean, dry sand. We have dismissed subsidence or uplift caused by tectonic movements that is associated with interpolate coupling in the subduction zone as the campuses are generally in excess of 100 kilometers of the Cascadia Subduction Zone.

SLOPE FAILURE

Earthquake-induced landsliding generally occurs in steeper slopes comprised of relatively weak soil deposits. We have assigned a general overall risk level of potential earthquake-induced slope failures or rock falls for each site based on our review of site topography at each of the campuses. Generally, the campuses are located in areas surrounded by relatively flat and gentle slopes; therefore, landslides are unlikely during postulated seismic scenarios.

FLOODING OR INDUNDATION

We evaluated the sites for risk of earthquake-induced flooding or inundation. Generally, sites that are inland and elevated away from tsunami inundation zones and away from large bodies of water that may develop seiches are considered to have a low risk.

♦ ♦ ♦

We appreciate the opportunity to provide these services. Please contact us if you have questions regarding the information contained in this review or if we can provide further services.

Sincerely,

GeoDesign, Inc.

Brett A. Shipton, P.E., G.E.
Senior Associate Engineer

Scott V. Mills, P.E., G.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER 56207 OREGON JULY 11, 2000 BRETT A SHIPTON

EXPIRES: 6/30/2010

VCL:BAS:JDT:kt
Attachment
One copy submitted (via email only)
Document ID: PortlandPS-5-01-081309-geol.doc

TABLES

Table 1. Summary of Geologic Site Hazards Evaluation for Portland Public Schools Campuses

Building #	School Name	Fault Rupture	Liquefaction	Differential Compaction	Landslide	Flooding or Inundation	Soil type	Source	Comments
1	**Abernathy Elementary** 2421 SE Orange, Portland, OR 97214	low	low	low	low	low	Qfch	Portland	
2	**Ainsworth Elementary** 2425 SW Vista, Portland, OR 97201	low	low	low	low	low	Tfg	Portland	
3	**Alameda Elementary** 2732 NE Fremont, Portland, OR 97212	low	low	low	low	low	Qff	Portland	
4	**Applegate Elementary** 7650 N Commercial Ave, Portland, OR 97217	low	low	low	low	low	Qff	Portland	
5	**Arleta Elementary** 5109 SE 66th, Portland, OR 97206	low to moderate	low	low	low	low	Qfc	Gladstone	
6	**Astor Elementary** 5601 N. Yale, Portland, OR 97203	low to moderate	low	low	low	low	Qff	Portland	
7	**Atkinson Elementary** 5800 SE Division, Portland, OR 97206	low	low	low	low	low	Qff	Mt Tabor	
8	**Ball Elementary** 4221 N Willis Blvd, Portland, OR 97203	low	low	low	low	low	Qfc	Portland	
9	**Beach Elementary** 1710 N. Humboldt, Portland, OR 97217	low	low	low	low	low	Qff	Portland	
10	**Beaumont Middle School** 4043 NE Fremont, Portland, OR 97212	low	low	low	low	low	Qfc	Mt Tabor	
11	**Benson High School** 546 NE 10th, Portland, OR 97232	low	low	low	low	low	Qff	Portland	
12	**Binnsmead Middle School** 2225 SE 87th, Portland, OR 97216	low	low	low	low	low	Qff	Mt Tabor	
13	**Boise Elliot Elementary** 620 N. Fremont, Portland, OR 97207	low	low	low	low	low	Qff	Portland	
14	**Bridger Elementary** 7910 SE Market, Portland, OR 97215	low	low	low	low	low	Qff	Mt Tabor	
15	**Bridlemile Elementary** 4300 SW 47th Drive, Portland, OR 97221	low to moderate	low	low	low	low	QTs	Lake Oswego	
16	**Brooklyn Elementary (Winterhaven)** 3830 SE 11th, Portland, OR 97211	low	high	low	low	low	Qfch	Lake Oswego	
17	**Buckman Elementary** 320 SE 16th, Portland, OR 97214	low	low	low	low	low	Qff	Portland	
18	**Capitol Hill Elementary** 8401 SW 17th, Portland, OR 97219	low	low	low	low	low	QTs	Lake Oswego	
19	**Chapman Elementary** 1445 NW 26th, Portland, OR 97210	low to moderate	low	low	low	low	Qff	Portland	
20	**Chief Joseph Elementary** 2409 N. Saratoga, Portland, OR 97217	low	low	low	low	low	Qff	Portland	
21	**Clarendon Elementary** 5103 N. Willis Blvd, Portland, OR 97203	low	low	low	low	low	Qfc	Portland	
22	**Clark Elementary** 2225 SE 87th, Portland, OR 97216	low	low	low	low	low	Qff	Mt Tabor	same as Binnsmead

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Building #	School Name	Fault Rupture	Liquefaction	Differential Compaction	Landslide	Flooding or Inundation	Soil type	Source	Comments
23	**Cleveland High School** 3400 SE 26th, Portland, OR 97202	low	moderate	low	low	low	Qfch/Qff	Lake Oswego	
24	**Columbia Transportation & Student Facility** 716 NE Marine Dr, Portland, OR 97211	low	high	low	low	moderate to high	Qal	Portland	
25	**Creston Elementary** 4701 SE Bush, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
26	**Creston Elementary Annex** 4620 SE Powell Blvd, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
27	**Duniway Elementary** 7700 SE Reed College Pl, Portland, OR 97202	low	low	low	low	low	Qff	Lake Oswego	
28	**East Sylvan** 1849 SW 58th Ave, Portland, OR 97221	low to moderate	low	low	low	low	QTb	Portland	
29	**Edwards Elementary** 1715 SE 32nd Pl, Portland, OR, 97214	low	low	low	low	low	Qff	Portland	
30	**Faubion Elementary** 3039 NE Portland Blvd, Portland, OR 97211	low	low	low	low	low	Qff	Portland	
31	**Fernwood Middle School** 1915 NE 33rd, Portland, OR 97212	low	low	low	low	low	Qff	Portland	
32	**Forest Park** 9935 NW Durrett, Portland, OR 97229	low to moderate	low	low	low	low	QTb	Linnton	
33	**Foster Holding** 5205 SE 86th Ave, Portland, OR 97266	low	low	low	low	low	Qff	Gladstone	
34	**Franklin High School** 5405 SE Woodward, Portland, OR 97206	low	low	low	low	low	Qff/Qfc	Mt Tabor	
35	**George Middle School** 10000 N. Burr, Portland, OR 97203	low	low	low	low	low	Qff	Portland	
36	**Glencoe Elementary** 825 SE 51st, Portland, OR 97215	low	low	low	low	low	Qff	Mt Tabor	
37	**Grant** 2245 NE 36th, Portland, OR 97212	low	low	low	low	low	Qff	Portland	
38	**Gray Middle School** 5505 SW 23rd, Portland, OR 97239	low to moderate	low	low	low	low	QTs	Lake Oswego	
39	**Gregory Heights Middle School** 7334 NE Siskiyou St, Portland, OR 97213	low	low	low	low	low	Qfc	Mt Tabor	
40	**Grout Middle School** 3119 SE Holgate Blvd.,Portland, OR 97202	low	low to moderate	low	low	low	Qff	Lake Oswego	
41	**Hayhurst Elementary** 5037 SW Iowa, Portland, OR 97221	low	low	low	low	low	QTs	Lake Oswego	
42	**Holladay Center** 2600 SE 71st, Portland, OR 97206	low	low	low	low	low	Qff	Mt Tabor	
43	**Holladay Center Anex** 7100 SE Division, Portland, OR 97206	low	low	low	low	low	Qff	Mt Tabor	
44	**Hollyrood Elementary** 3560 NE Hollyrood Ct., Portland, OR 97212	low	low	low	low	low	Qff	Portland	

Table 1. Summary of Geologic Site Hazards Evaluation for Portland Public Schools Campuses

Building #	School Name	Fault Rupture	Liquefaction	Differential Compaction	Landslide	Flooding or Inundation	Soil type	Source	Comments
45	**Hosford Middle School** 2303 SE 28th Place, Portland, 97214	low	low	low	low	low	Qff/Qaf	Portland	
46	**Humboldt Elementary** 4915 N. Gantenbein, Portland, OR 97217	low	low	low	low	low	Qff	Portland	
47	**Irvington Elementary** 1320 NE Brazee, Portland, OR 97212	low	low	low	low	low	Qff	Portland	
48	**J.L. Meek Technical** 4039 NE Alberta Ct., Portland, OR 97211	low	low	low	low	low	Qfc	Mt Tabor	
49	**Jackson Middle School** 10625 SW 35th, Portland, OR 97219	low	low	low	low	low	QTb	Lake Oswego	
50	**James John Elementary** 7439 N. Charleston, Portland, OR 97203	low	low	low	low	low	Qff	Linnton	
51	**Jefferson High School** 5210 N. Kerby, Portland, OR 97217	low	low	low	low	low	Qff	Portland	
52	**Kellogg Middle School** 3330 SE 69th Ave, Portland, OR 97206	low	low	low	low	low	Qff	Mt Tabor	
53	**Kelly Elementary** 9030 SE Cooper, Portland, OR 97266	low to moderate	low	low	low	low	Qfc	Gladstone	
54	**Kelly Learning Center**								
55	**Kenton Elementary** 7528 N Fenwick Ave, Portland, OR, 97217	low	low	low	low	low	Qfc	Portland	
56	**King Elementary** 4906 NE 6th, Portland, OR 97211	low	low	low	low	low	Qff	Portland	
57	**Lane Middle School** 7200 SE 60th, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
58	**Laurelhurst Elementary** 840 NE 41st, Portland, OR 97232	low	low	low	low	low	Qff	Mt Tabor	
59	**Lee Elementary** 2222 NE 92nd, Portland, OR 97220	low	low	low	low	low	Qfc	Mt Tabor	
60	**Lent Elementary** 5105 SE 97th, Portland, OR 97266	low	low	low	low	low	Qfc	Gladstone	
61	**Lewis Elementary** 4401 SE Evergreen, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
62	**Lincoln High School** 1600 SW Salmon, Portland, OR 97205	low	low	low	low	low	Qff	Portland	
63	**Llewelyn Elementary** 6301 SE 14th, Portland, OR 97202	low to moderate	low to moderate	low	low	low	Qff	Lake Oswego	
64	**M.L. King Jr.**								
65	**Madison High School** 2735 NE 82nd, Portland, OR 97220	low	low	low	low	low	Qfc	Mt Tabor	
66	**Maplewood Elementary** 7452 SW 52nd, Portland, OR 97219	low	low	low	low	low	Tsfh	Lake Oswego	

Table 1. Summary of Geologic Site Hazards Evaluation for Portland Public Schools Campuses

Building #	School Name	Fault Rupture	Liquefaction	Differential Compaction	Landslide	Flooding or Inundation	Soil type	Source	Comments
67	**Markham Elementary** 10531 SW Capitol Hwy, Portland, OR 97219	low	low	low	low	low	QTb	Lake Oswego	
68	**Marshall** 3905 SE 91st, Portland, OR 97266	low	low	low	low	low	Qfc	Gladstone	
69	**Marysville Elementary** 7733 SE Raymond, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
70	**Meek Elementary** 4039 NE Alberta Ct, Portland, OR 97211	low	low	low	low	low	Qfc	Mt Tabor	
71	**Metro Learning Center** 2033 NW Glisan, Portland, OR 97209	low	low	low	low	low	Qff	Portland	
72	**Monroe Facility** 531 SE 14th Avenue, Portland, OR 97214	low	low	low	low	low	Qff	Portland	
73	**Mt. Tabor Middle School** 5800 SE Ash, Portland, OR 97215	low	low	low	low	low	Qff	Mt Tabor	
74	**Ockley Green Middle School** 6031 N. Montana, Portland, OR 97217	low	low	low	low	low	Qff	Portland	
75	**Peninsula Elementary** 8125 N, Emerald, Portland, OR 97217	low	low	low	low	low	Qfc	Portland	
76	**Portsmouth Middle School** 5103 N. Willis Blvd, Portland, OR 97203	low	low	low	low	low	Qfc	Portland	Same as Clarendon
77	**Rice Elementary** 6433 NE Tillamook, Portland, OR 97213	low	low	low	low	low	Qfc	Mt Tabor	
78	**Richmond Elementary** 2276 SE 41st, Portland, OR 97214	low to moderate	low	low	low	low	Qff	Mt Tabor	
79	**Rieke Elementary** 1405 SW Vermont, Portland, OR 97219	low	low	low	low	low	Tfsh/QTs	Lake Oswego	
80	**Rigler Elementary** 5401 NE Prescott, Portland, OR 97218	low	low	low	low	low	Qfc	Mt Tabor	
81	**Roosevelt High School** 6941 N. Central, Portland, OR 97203	low	low	low	low	low	Qff	Portland	
82	**Rose City Park Elementary** 2334 NE 57th Ave, Portland, OR 97213	low	low	low	low	low	Qfc	Mt Tabor	
83	**Sabin Elementary** 4013 NE 18th, Portland, OR 97212	low	low	low	low	low	Qff	Portland	
84	**Sacajewea Head Start** 4800 NE 74th, Portland, OR 97218	low	low	low	low	low	Qfc	Mt Tabor	
85	**Scott Elementary** 6700 NE Prescott, Portland, OR 97218	low	low	low	low	low	Qfc	Mt Tabor	
86	**Sellwood Middle School** 8300 SE 15th, Portland, OR 97202	low	high	low	low	low	Qff	Lake Oswego	
87	**Sitton Elementary** 9930 N. Smith, Portland, OR 97203	low to moderate	low	low	low	low	Qff	Linnton	
88	**Skyline Elementary** 11536 NW Skyline Blvd.,Portland, OR 97231	low	low	low	low	low	Tcr	Linnton	

Table 1. Summary of Geologic Site Hazards Evaluation for Portland Public Schools Campuses

Building #	School Name	Fault Rupture	Liquefaction	Differential Compaction	Landslide	Flooding or Inundation	Soil type	Source	Comments
89	**Smith Elementary** 8935 Sw 52nd Ave, Portland, OR, 97219-3322	low	low	low	low	low	QTb	Lake Oswego	
90	**Stephenson Elementary** 2627 Sw Stephenson, Portland, OR 97219	low	low	low	low	low	QTb	Lake Oswego	
91	**Sunnyside Elementary** 3421 SE Salmon, Portland,OR 97214	low to moderate	low	low	low	low	Qff	Portland	
92	**Sylvan School Facility**								
93	**Terwilliger School Facility** 6318 SW Corbett, Portland, OR 97239	low	high	low	low	low	Qff	Lake Oswego	
94	**Tubman Middle School** 2231 N. Flint , Portland, OR 97227	low to moderate	low	low	low	low	Qff	Portland	
95	**Vernon Elementary** 2044 NE Killingsworth, Portland, OR 97211	low	low	low	low	low	Qfc	Portland	
96	**Vestal Elementary** 161 NE 82nd, Portland, OR 97220	low	low	low	low	low	Qfc	Mt Tabor	
97	**West Sylvan Middle School** 8111 SW West Slope Dr.,Portland, OR 97225	low	low	low	low	low	QTb	Linnton	
98	**Whitaker Lakeside Facility** 5135 NE Columbia, Portland, OR 97211	low	moderate	low	low	high	Qal/Qff	Mt Tabor	
99	**Whitman Elementary** 7326 SE Flavel, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
100	**Wilcox Elementary** 833 NE 74th Avenue, Portland, OR 97213	low	low	low	low	low	Qfc	Mt Tabor	
101	**Wilson High School** 1151 SW Vermont, Portland, OR 97219	low	low	low	low	low	Tfsh/QTs	Lake Oswego	
102	**Woodlawn Elementary** 7200 NE 11th, Portland, OR 97211	low	low	low	low	low	Qff	Portland	
103	**Woodmere Elementary** 7900 SE Duke, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
104	**Woodstock Elementary** 5601 SE 50th, Portland, OR 97206	low	low	low	low	low	Qfc	Gladstone	
105	**Youngson Elementary** 2704 SE 71st, Portland, OR 97206	low	low	low	low	low	Qff	Mt Tabor	

Explanation

Qal	Alluvium (Quaternary) - River and stream deposits of silt, sand and organic-rich clay with subordinate gravel of mixed lithologies
Qff	Fine-grained facies (Pleistocene) - Coarse sand to silt deposited by catastrophic floods.
Qfc	Coarse-grained facies (Pleistocene) - Pebble to boulder gravel with silt and coarse sand matrix.
Qfch	Channel facies (Pleistocene) - Complexly interlayered and variable silt, sand, and gravel deposited in major flood channel
QTb	Boring Lava (Pliocene to Pleistocene) - Light gray to gray, basalt and basaltic andesite flows erupted from a series of local vents.
QTs	Neogene mudstones (Miocene to Pleistocene) - Friable to weak, massive to thinly bedded siltstones and claystones.
Tcr	Undifferentiated Columbia River Basalt Group (middle Miocene) - Basalt encountered in deep wells northeast of Tualatin Mountains.
Tfg	Basalt of Gingko (middle Miocene).
Tsfh	Basalt of Sand Hollow (middle Miocene).

CHAPTER 24.85

SEISMIC DESIGN REQUIREMENTS FOR EXISTING BUILDINGS

Sections:

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24.85.040 Change of Occupancy or Use.
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24.85.051 Mezzanine Additions.
24.85.055 Structural Systems Damaged by Catastrophic Events.
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25.85.075 Egress Through Existing Buildings.
24.85.080 Application of Other Requirements.
24.85.090 Fee Reductions.
24.85.095 Appeals.

24.85.010 Scope.

A. The provisions of this chapter prescribe the seismic design requirements for existing buildings undergoing changes of occupancy, additions, alterations, catastrophic damage, fire, or earthquake repair, or mandatory or voluntary seismic strengthening. The requirements of this chapter only apply to buildings for which a building permit has been applied for to change the occupancy classification, add square footage to the building, alter or repair the building.

B. Under the authority provided by State law, the provisions of this chapter prescribing seismic rehabilitation standards for existing buildings can be used in lieu of meeting the requirements of the current edition of the State of Oregon Structural Specialty Code.

24.85.015 Structural Design Meeting.

Upon request, BDS engineering staff is available to meet with an owners design engineer to review proposed seismic strengthening plans in a pre-design meeting. A written record of the meeting discussion and determinations will be placed in the permit record.

24.85.020 Seismic Related Definitions.

The definitions contained in this Section relate to seismic design requirements for existing buildings outlined in this Chapter.

A. **ASCE 31** means the *Seismic Evaluation of Existing Buildings ASCE/SEI 31-03* published by the American Society of Civil Engineers and the Structural Engineering Institute.

B. **ASCE 31 Evaluation** means the process of evaluating an existing building for the potential earthquake-related risk to human life posed by that building, or building component, and the documentation of that evaluation, performed and written according to the provisions of ASCE 31. ASCE 31 Evaluation is divided into two categories:

1. Non-essential facilities evaluation means a Tier 1 and a Deficiency-Only Tier 2 analysis to the Life Safety (LS) performance level as defined by ASCE 31 unless a complete Tier 2 analysis is required by ASCE 31.

2. Essential facilities evaluation means a Tier 2 analysis to the Immediate Occupancy (IO) performance level as defined by ASCE 31.

C. **ASCE 31 Improvement Standard** means the Tier 1 and Tier 2 Life Safety Performance Level Criteria of ASCE 31.

D. **ATC 20** means the 1989 Edition of the manual on "Procedures for Post Earthquake Safety Evaluation of Buildings" published by Applied Technology Council.

E. **BDS** means the City of Portland's Bureau of Development Services.

F. **Building Addition** means an extension or increase in floor area or height of a building or structure.

G. **Building Alteration** means any change, addition or modification in construction.

H. **Catastrophic Damage** means damage to a building that causes an unsafe structural condition from fire, vehicle collision, explosion, or other events of similar nature.

I. **Essential Facility** has the same meaning as defined in the OSSC.

J. **Fire and Life-safety for Existing Buildings (FLEx) Guide** means a code guide published by the Bureau of Development Services, outlining alternative materials and methods of construction that are allowed for existing buildings in Portland.

K. **FM 41 Agreement** means a joint agreement between the Fire Bureau, the Bureau of Development Services and a building owner to schedule improvements to the building following a determination of the fire and life safety hazards posed by the existing condition of the building as provided under Oregon law.

L. **Live/Work Space** means a combination working space and dwelling unit. A live/work space includes a room or suite of rooms on one or more floors designed for and occupied by not more than one family and including adequate working space reserved for the resident's occupancy. A live/work space is individually equipped with an enclosed bathroom containing a lavatory, water closet, shower/and or bathtub and appropriate venting.

M **Net Floor Area** means the entire area of a structurally independent building, including an occupied basement, measured from the inside of the permanent outer building walls, excluding any major vertical penetrations of the floor, such as elevator and mechanical shafts.

N. **Oregon Structural Specialty Code (OSSC)** means the provisions of the State of Oregon Structural Specialty Code as adopted by Section 24.10.040 A.

O. **Reinforced Masonry** means masonry having both vertical and horizontal reinforcement as follows:

1. Vertical reinforcement of at least 0.20 in^2 in cross-section at each corner or end, at each side of each opening, and at a maximum spacing of 4 feet throughout. One or two story buildings may have vertical reinforcing spaced at greater than 4 feet throughout provided that a rational engineering analysis is submitted which shows that existing reinforcing and spacing provides adequate resistance to all required design forces without net tension occurring in the wall.
2. Horizontal reinforcement of at least 0.20 in^2 in cross-section at the top of the wall, at the top and bottom of wall openings, at structurally connected roof and floor openings, and at a maximum spacing of 10 feet throughout.
3. The sum of the areas of horizontal and vertical reinforcement shall be at least 0.0005 times the gross cross-sectional area of the element.
4. The minimum area of reinforcement in either direction shall not be less than 0.000175 times the gross cross-sectional area of the element.

P. **Roof Covering Repair or Replacement** means the installation of a new roof covering following the removal of an area of the building's roof covering exceeding 50% or more of the total roof area within the previous five year period.

Q. **Unreinforced Masonry (URM)** means adobe, burned clay, concrete or sand-lime brick, hollow clay or concrete block, hollow clay tile, rubble and cut stone and unburned clay masonry that does not satisfy the definition of reinforced masonry as defined herein. Plain unreinforced concrete shall not be considered unreinforced masonry for the purpose of this Chapter.

R. **Unreinforced Masonry Bearing Wall** means a URM wall that provides vertical support for a floor or roof for which the total superimposed vertical load exceeds 200 pounds per lineal foot of wall.

S. **Unreinforced Masonry Bearing Wall Building** means a building that contains at least one URM bearing wall.

24.85.030 Seismic Improvement Standards.

For changes of occupancy structural additions, building alterations and catastrophic or earthquake damage repair, the design standard shall be the current edition of the OSSC unless otherwise noted by this Chapter.

24.85.040 Change of Occupancy or Use.

The following table shall be used to classify the relative hazard of all building occupancies:

TABLE 24.85-A		
Relative Hazard Classification	**OSSC Occupancy Classification**	**Seismic Improvement Standard**
5 (Highest)	A, E, I-2, I-3, H-1, H-2, H-3, H-4, H-5	OSSC
4	R-1, R-2, SR, I-1, I-4	
3	B, M	ASCE 31
2	F-1, F-2, S-1, S-2	
1 (Lowest)	R-3, U	

A. **Occupancy Change to a Higher Relative Hazard Classification.** An occupancy change to a higher relative hazard classification will require seismic improvements based upon the factors of changes in the net floor area and the occupant load increases as indicated in Table 24.85-B below. All improvements to either the OSSC or ASCE 31 improvement standard shall be made such that the entire building conforms to the appropriate standard indicated in Table 24.85-B.

TABLE 24.85-B				
Percentage of Building Net Floor Area Changed		**Occupant Load Increase**	**Required Improvement Standard**	**Relative Hazard Classification**
1/3 of area or less	and	Less than 150	None	1 through 5
More than 1/3 of area	or	150 and above	ASCE 31	1, 2, and 3
More than 1/3 of area	or	150 and above	OSSC	4 and 5

Multiple occupancy changes to a single building may be made under this section without triggering a seismic upgrade provided the cumulative changes do not exceed

1/3 of the building net floor area or add more than 149 occupants with respect to the legal building occupancy as of October 1, 2004.

B. Occupancy Change to Same or Lower Relative Hazard Classification. An occupancy change to the same or a lower relative hazard classification or a change in use within any occupancy classification will require seismic improvements using either the OSSC or ASCE 31 improvement standard, as identified in Table 24.85-A above, where the change results in an increase in occupant load of more than 149 people as defined by the OSSC. Where seismic improvement is required, the entire building shall be improved to conform to the appropriate improvement standard identified in Table 24.85-A.

Multiple occupancy changes to a single building may be made under this section without triggering a seismic upgrade provided the cumulative changes do not result in the addition of more than 149 occupants with respect to the legal building occupancy as of October 1, 2004.

C. Occupancy Change to Live Work Space. Any building occupancy classified as relative hazard category 1, 2, or 3 may undergo a change of occupancy to live/work space provided that:

1. The building shall be improved such that the entire building conforms to the ASCE 31 improvement standard; and
2. The building meets the fire and life safety standards of either the FLEx Guide or the current OSSC.
3. Any Unreinforced Masonry bearing wall building converted to live/work space, regardless of construction costs, shall be improved such that the entire building conforms to the ASCE 31 improvement standard.

D. Occupancy Change to Essential Facilities. All structures which are being converted to essential facilities, as defined in the OSSC, shall comply with current state code seismic requirements, regardless of other requirements in this section.

24.85.050 Building Additions or Structural Alterations.

An addition that is not structurally independent from an existing building shall be designed and constructed such that the entire building conforms to the seismic force resistance requirements for new buildings unless the three conditions listed below are met. Furthermore, structural alterations to an existing building or its structural elements shall also meet the following three conditions:

A. The addition or structural alteration shall comply with the requirements for new buildings;

B. The addition or structural alteration shall not increase the seismic forces in any structural element of the building by more than 5 percent unless the capacity of the element subject to the increased forces is equal to or greater than that required for new buildings. Multiple force increases on an element are allowed provided the cumulative force increase does not exceed 5 percent of the force on the element from its original, unaltered state; and

C. The addition or structural alteration shall not decrease the seismic resistance of any structural element of the existing building unless the reduced seismic resistance of the element is equal to or greater than that required for new buildings.

24.85.051 Mezzanine Additions.

A mezzanine addition shall not require seismic strengthening of the entire building when all of the following conditions are met:

A. Entire building strengthening is not required by any other provision contained in this Title;

B. The net floor area of the of the proposed mezzanine addition is less than 1/3 of the net floor area of the building;

C. The mezzanine addition does not result in an occupant load increase, as defined by the OSSC, of more than 149 people; and

D. Subsections A, B and C of Section 24.85.050 shall also apply to mezzanine additions.

24.85.055 Structural Systems Damaged by Catastrophic Events.

A. Building structural systems damaged less than or equal to 50%.

1. If a building is damaged by a catastrophic event such that the area of the resulting structural damage is less than or equal to 50 percent of the building's net area, all damaged lateral load resisting components of the a-building's structural system must be designed and constructed to current provisions of the OSSC. These components must also be connected to the balance of the undamaged lateral load resisting system in conformance with current code provisions. Undamaged components need not be upgraded to current lateral load provisions of the current code, unless required by other provisions of this title.

2. New lateral system vertical elements must be compatible with any existing lateral system elements, including foundations. In multistory buildings, the engineer shall confirm that the new lateral system vertical elements do not introduce soft or weak story seismic deficiencies, as defined by ASCE 31, where they did not previously exist, or make existing conditions more hazardous.

B. **Building structural systems damaged more than 50%.** Where a building is damaged by a catastrophic event such that the area of the resulting structural damage is greater than 50 percent of the building's net floor area, all lateral load resisting components of the entire building's structural system must be designed and constructed to the current provisions of the OSSC.

24.85.056 Structural Systems Damaged by an Earthquake.

As a result of an earthquake, the Director may determine through either an ATC 20 procedure or through subsequent discovery any structure or portion thereof to be in an unsafe condition as defined by State law. As a result of making this determination, the Director may declare the structure or portion thereof to be a public nuisance and to be repaired or rehabilitation as provided in Subsections A through C below, or abated by demolition or removal in accordance with Title 29. For the purposes of this Section, an "unsafe condition" includes, but is not limited to any portion, member or appurtenance of a building that has become detached or dislodged or appears likely to fail or collapse and thereby injure persons or damage property; or any portion of a building or structure that has been damaged to the extent that the structural strength or stability of the building is substantially less than it was prior to the damaging event.

A. Buildings built prior to January 1, 1974 with lateral support systems that have unsafe conditions shall be repaired or improved to resist seismic forces such that the repaired lateral system conforms to the ASCE 31 improvement standard.

1. Where less than 50% of the lateral support system has been damaged, only the damaged elements must be repaired.

2. Where 50% or more of the lateral support system has been damaged, then the entire lateral support system must be repaired to resist seismic forces such that the repaired system conforms to the ASCE 31 improvement standard.

B. Buildings built on or after January 1, 1974 with lateral support systems that have unsafe conditions shall be repaired or improved to resist seismic forces such that the repaired lateral system conforms to the code to which the building was originally designed, but not less than that required to conform to the ASCE 31 improvement standard.

1. Where less than 50% of the lateral support system has been damaged, only the damaged elements must be repaired.

2. Where 50% or more of the lateral support system has been damaged, then the entire lateral support system must be repaired to resist seismic forces such that the repaired system conforms to the code to which the building was originally designed, but not less than that required to conform to the ASCE 31 improvement standard.

C. New lateral system vertical elements must be compatible with any existing lateral system elements, including foundations. In multistory buildings, the engineer shall confirm that the new lateral system vertical elements do not introduce soft or weak story seismic deficiencies, as defined by ASCE 31, where they did not previously exist, or make existing conditions more hazardous.

24.85.060 Required Seismic Evaluation.

When an alteration for which a building permit is required has a value (not including costs of mechanical, electrical, plumbing, permanent equipment, painting, fire extinguishing systems, site improvements, eco-roofs and finish works) of more than $175,000, an ASCE 31 evaluation is required. This value of $175,000 shall be modified each year after 2004 by the percent change in the R.S Means Construction Cost Index for Portland on file with the Director. A letter of intent to have an ASCE 31 evaluation performed may be submitted along with the permit application. The evaluation must be completed before any future permits will be issued. The following shall be exempted from this requirement:

A. Buildings constructed or renovated to seismic zone 2, 2b or 3 under a permit issued after January 1, 1974.

B. Detached One-and two-family dwellings and their accessory structures.

C. Single story, light frame metal and light frame wood buildings, not more than 20 feet in height from the top surface of the lowest floor to the highest interior overhead finish and ground area of 4,000 square feet or less.

A previously prepared seismic study may be submitted for consideration by the Director as equivalent to an ASCE 31 evaluation.

24.85.065 Seismic Strengthening of Unreinforced Masonry Bearing Wall Buildings.

When any building alterations or repairs occur at an Unreinforced Masonry Bearing Wall Buildings, all seismic hazards shall be mitigated as set forth in Subsections A and B below. A previously permitted seismic strengthening scheme designed in accordance with FEMA 178/310 may be submitted for consideration by the Bureau Director as equivalent to the ASCE 31 improvement standard.

A. **Roof Repair or Replacement.** When a roof covering is repaired or replaced, as defined in 24.85.020, the building structural roof system, anchorage, and parapets shall be repaired or rehabilitated such that, at a minimum, the wall anchorage for both in-plane and out-of-plane forces at the roof and parapet bracing conform to the ASCE 31 improvement standard. Inplane brick shear tests are not required as part of the ASCE evaluation under this subsection.

B. **Additional Triggers.**

1. **Building alterations or repair.** When the cost of alteration or repair work which requires a building permit in a 2 year period exceeds the following criteria, then the building shall be improved to resist seismic forces such that the entire building conforms to the ASCE 31 improvement standard.

Table 24.85-C	
Building Description	Cost of Alteration or Repair
Single Story Building	$40 per square foot
Buildings Two Stories or Greater	$30 per square foot

2. **Special building hazards.** Where an Unreinforced Masonry Building of any size contains any of the following hazards, the building shall be seismically improved if the cost of alteration or repair exceeds $30 per square foot:
   a. The Building possesses an Occupancy Classification listed within the Relative Hazard Category 5 as determined in Section 24.85.040 of this Chapter; or
   b. The building is classified as possessing either vertical or plan irregularities as defined in the OSSC.

3. **Exclusions from cost calculations.** Costs for site improvements, eco-roofs, mandated FM41 agreements, mandated ADA improvements, mandated non-conforming upgrades under Title 33, mandated elevator improvements and mandated or voluntary seismic improvements or work exempted from permit as described in Chapter 1 of the OSSC will not be included in the dollar amounts listed in Sub-sections 1 and 2 above.

4. **Live/Work spaces in Unreinforced Masonry buildings**. See Section 24.85.040 B for requirements when a Unreinforced Masonry building is converted to contain live/work spaces.

5. **Automatic cost increase.** The dollar amounts listed in subsections 1 and 2 above shall be modified each year after 2004 by the percent change in the R.S. Means of Construction Cost Index for Portland, Oregon. The revised dollar amounts will be made available at the Development Services Center.

24.85.067 Voluntary Seismic Strengthening.

Subject to permit approval, a building may be strengthened to resist seismic forces on a voluntary basis provided all of the following conditions are met:

A. Mandatory seismic strengthening is not required by other provisions of this Title;

B. The overall seismic resistance of the building or elements shall not be decreased such that the building is more hazardous;

C. Testing and special inspection are in accordance with the OSSC and the City of Portland Administrative Rules;

D. The standard used for the seismic strengthening is clearly noted on the drawings along with the pertinent design parameters; and,

E. A written narrative shall be clearly noted on the drawings summarizing the building lateral system, seismic strengthening and known remaining deficiencies. The summary information shall reflect the level of analysis that was performed on the building.

24.85.070 Phasing of Improvements.

A. The Director may approve a multi-year phased program of seismic improvements when the improvements are pre-designed and an improvement/implementation plan is approved by the Director. The maximum total time allowed for completion of phased improvements shall be ten years. A legal agreement between the building owner and the City of Portland shall be formulated outlining the phased seismic improvements and shall be recorded with the property deed at the County.

B. Upon review, the Director may extend the maximum time for the phased improvements. The Director shall adopt rules under Section 3.30.035 describing the process for granting an extension.

24.85.075 Egress Through Existing Buildings.

The building structure and seismic resistance of an egress path through, under or over an existing building must meet the required seismic improvement standard specified in Section 24.85.040, Table 24.85-A, under any of the following conditions:

A. The egress path is from an adjacent new building or addition and the new building or addition area equals 1/3 or more of the existing building area; or,

B. The egress path is from an adjacent existing building that undergoes alterations or a change of occupancy requiring its egress path(s) meet the seismic improvement standards as required by this Chapter; or

C. The additional occupant load, as determined by the OSSC, using the egress path through the existing building is 150 people or more.

24.85.080 Application of Other Requirements.

Building permit applications to improve the seismic capability of a building shall not trigger: accessibility improvements so long as the seismic improvement does not lessen accessibility; fire life safety improvements so long as the seismic improvement does not lessen the buildings fire resistance or exiting capability; landscape improvements required by Chapter 33; street tree improvements required by Section 20.40.070.

Conformance with these regulations may not exempt buildings from future seismic regulations.

24.85.090 Fee Reductions.

Building permit, plan review and fire life safety review fees for structural work related to seismic strengthening covered by this Chapter will be waived when such fees total less than $2,500, and will be reduced by 50% when such fees would total $2,500 or more.