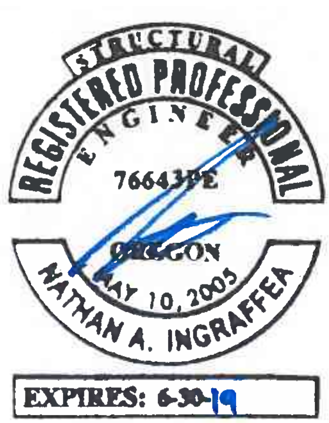
SEISMIC ASSESSMENTS FOR THE BEAVERTON SCHOOL DISTRICT

(VOLUME 1 OF 4)

KPFF PROJECT NO. 10021800125

APRIL 12, 2019



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Seismic Assessments for the Beaverton School District

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Executive Summary

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Seismic Assessments
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Executive Summary

Project Intent
In 1995, the Beaverton School District performed a Lateral Force Investigation of their school district facilities. The 1995 report and analysis was based on the provisions of the 1993 Edition of the Oregon Structural Specialty Code using seismic UBC Zone 3. In 2000, 2010 and 2013, reports were completed which summarized the status of the progress since the 1995 Lateral Force Investigation report. In September of 2013, a Next-In-Line Seismic Assessment was completed for seven schools based on ASCE-31. These schools were Cooper Mountain, Beaver Acres, Cedar Mill, ACMA, Beaverton HS, Aloha HS and William Walker.

The purpose of this report is to provide the Beaverton School District with an updated summary of how each campus is expected to perform during a seismic event according to ASCE 41-13. The current report also satisfies the requirement of section 2 (4), chapter 248, Oregon Laws 2005 which notes:

> *"Subject to available funding…the local school district board…shall conduct such additional seismic safety evaluations of building as each of those boards considers necessary. The boards shall conduct the evaluations for life safety as set forth in the American Society of Civil Engineers Standard for Seismic Evaluation of Existing Buildings (SEI/ASCE 31-03), 2003 Edition, or in any later edition of that standard allowed for seismic safety evaluation use under a rule adopted by the State Department of Geology and Mineral Industries or using a stricter standard selected by the board that conducts the survey."*

The information in this report can be used to prioritize future seismic improvements within the district and to step toward meeting the goal of the 2017 Oregon Revised Statute (ORS) 455.400 which notes:

> *"Subject to available funding, all seismic rehabilitations or other actions to reduce seismic risk must be completed before January 1, 2032."*

Seismic Assessment Process
Seismic assessments included a review of available structural drawings, walkthroughs of the buildings and preliminary seismic evaluations to determine likely seismic deficiencies.

ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, was utilized as this was the current standard at the time of the campus evaluations. ASCE 41-13 was developed around 2013 and was a combination of two preceding ASCE documents, ASCE 31-03 and ASCE 41-06. Both of these documents have FEMA and ATC predecessors dating back to the 1990s. ASCE 41-17 was recently released and is beginning to be utilized. ASCE 41-17 utilizes a similar checklist style of evaluations.

We do not expect the content included in this report to significantly change based on the updates included in ASCE 41-17.

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report, where appropriate.

A list of building type definitions used in ASCE 41-13 is provided in Table 1 for reference.

ASCE 41 Building Types	
Abbreviation	Description
W1	Wood Light Frame
W1A	Multi-Story, Multi-Unit Residential Wood Frame
W2	Wood Frame, Commercial and Industrial
S1	Steel Moment Frame with Stiff Diaphragm
S1A	Steel Moment Frame with Flexible Diaphragm
S2	Steel Braced Frame with Stiff Diaphragm
S2A	Steel Braced Frame with Flexible Diaphragm
S3	Steel Light Frame
S4	Dual System with Backup Steel Moment Frame and Stiff Diaphragm
S5	Steel Frame with Infill Masonry Shear Wall and Stiff Diaphragm
S5A	Steel Frame with Infill Masonry Shear Wall and Flexible Diaphragm
C1	Concrete Moment Frame
C2	Concrete Shear Wall with Stiff Diaphragm
C2A	Concrete Shear Wall with Flexible Diaphragm
C3	Concrete Frame with Infill Masonry Shear Wall and Stiff Diaphragm
C3A	Concrete Frame with Infill Masonry Shear Wall and Flexible Diaphragm
PC1	Precast Concrete or Tilt-Up Concrete Shear Wall with Flexible Diaphragm
PC1A	Precast Concrete or Tilt-Up Concrete Shear Wall with Stiff Diaphragm
PC2	Precast Concrete Frame with Shear Wall
PC2A	Precast Concrete Frame Without Shear Wall
RM1	Reinforced Masonry Bearing Wall
RM1A	Reinforced Masonry Bearing Wall with Stiff Diaphragm
URM	Unreinforced Masonry Bearing Wall with Flexible Diaphragm
URMA	Unreinforced Masonry Bearing Wall with Stiff Diaphragm

TABLE 1: ASCE 41-13 BUILDING TYPE ABBREVIATION DESCRIPTIONS

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for Risk Category III buildings, which is the code required Risk Category for new school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

These assessments are high level and used the Tier 1 checklists as guidance. A complete Tier 1 evaluation was beyond the scope of this seismic assessment and was not performed for this report. There are a number of items in the checklists that are marked as unknown. These items should be confirmed during a complete Tier 1 evaluation before implementing a retrofit plan. Should any of these structures be chosen for a seismic rehabilitation grant application, comprehensive ASCE 41 evaluations will be required to be completed. The results of comprehensive evaluations are anticipated to indicate retrofit work within the cost per square foot estimates provided in this assessment.

Not all nonstructural deficiencies found were listed for each campus. Typical deficiencies, not specifically listed, are fall prone contents and tall/narrow contents (furniture, file cabinets, etc.) and MEP bracing/anchorage, including kitchen equipment (double stacked ovens).

Hazards due to slope failure are unlikely to exist at any of the campuses but this can only be confirmed by a qualified geotechnical engineer. We also recommend that liquefaction potential be confirmed with a geotechnical engineer as this hazard could affect building foundations and slab-on-grade structures. Note that all probable costs provided in this report assume liquefaction is not present.

Estimated Probable Costs

Estimated probable costs per square foot for seismic rehabilitation of discovered deficiencies are provided for each site. Both structural and nonstructural deficiencies listed for each site are included in the estimate. The dollar per square foot amounts assume that seismic rehabilitation is not occurring in conjunction with other upgrade work and includes an allotment for repairing architectural finishes and features after the structural work is complete. These costs are based on previous seismic rehabilitation studies of other campuses of similar building construction types and ages. These estimates are not fully developed cost estimates and are intended to provide the Beaverton School District with a rough estimate of probable costs. These estimates do not include soft costs that could be up to an additional +/- 30%.

Non-seismic related structural deficiencies observed on site are also listed. These items are listed under “Additional Structural Observations”. The costs to repair these items are not included in the seismic cost per square foot estimates.

Organization of the Report

Each campus is numbered and grouped based on Campus Type. Each campus type is color-coded throughout the report for ease of reference.

Campus Type	Campus Number
Elementary Schools (including K-8)	01 - 34
Middle Schools	35 - 43
High Schools	44 - 49
Option Schools	50 - 54
Support Facilities	55 – 60

We have created individual reports for each campus. These reports should be used in conjunction with this executive summary as background information.

The appendices include the completed checklists that were used as a guideline for determining deficiencies for each campus and the campus risk plans. The appendices are as follows:

- **Appendix A:** Elementary School Tier 1 Checklists
- **Appendix B:** Middle Schools Tier 1 Checklists
- **Appendix C:** High School Tier 1 Checklists
- **Appendix D:** Option School Tier 1 Checklists
- **Appendix E:** Support Facility Tier 1 Checklists
- **Appendix F:** Campus Risk Zone Plans
    - Risk Zone Plans were prepared for those campuses that do not meet the Life Safety Performance Objective. These plans show color-coded zones that indicate the expected seismic performance level across the campus. Campuses with multiple additions and alterations over a long period of time typically have a larger variety of expected seismic performances.

There are five campuses that KPFF has recently completed full ASCE 41 Tier 1 evaluation reports, strengthening schemes and cost estimates for. These schools are:

- 03 – Beaver Acres Elementary School (ASCE 41-13 for SRGP Winter 2017 and Fall 2018)
- 06 – Cedar Mill Elementary School (ASCE 41-17 for SRGP Fall 2018)
- 08 – Cooper Mountain Elementary School (ASCE 41-17 for SRGP Fall 2018)
- 44 – Aloha High School (ASCE 41-13 for awarded SRGP Winter 2017/currently under design)
- 45 – Beaverton High School (ASCE 41-13)

There are seven campuses that were constructed recently enough that they are considered "benchmark buildings" according to ASCE 41-13 and automatically comply with the Damage Control Performance Level due to the year and type of construction. Checklists were not necessarily completed for these campuses:

- 14 – Hazeldale Elementary School (constructed in 2018)
- 27 – Sato Elementary School (constructed in 2017)
- 32 – Vose Elementary School (constructed in 2017)
- 34 – William Walker Elementary School (constructed in 2018)
- 41 – Timberland Middle School (constructed in 2017)
- 46 – Mountainside High School (constructed in 2017)
- 50 – Arts & Communication ACMA (to be constructed in 2019, 2009 Performing Arts Center)

Beaverton School District

Map of Campuses

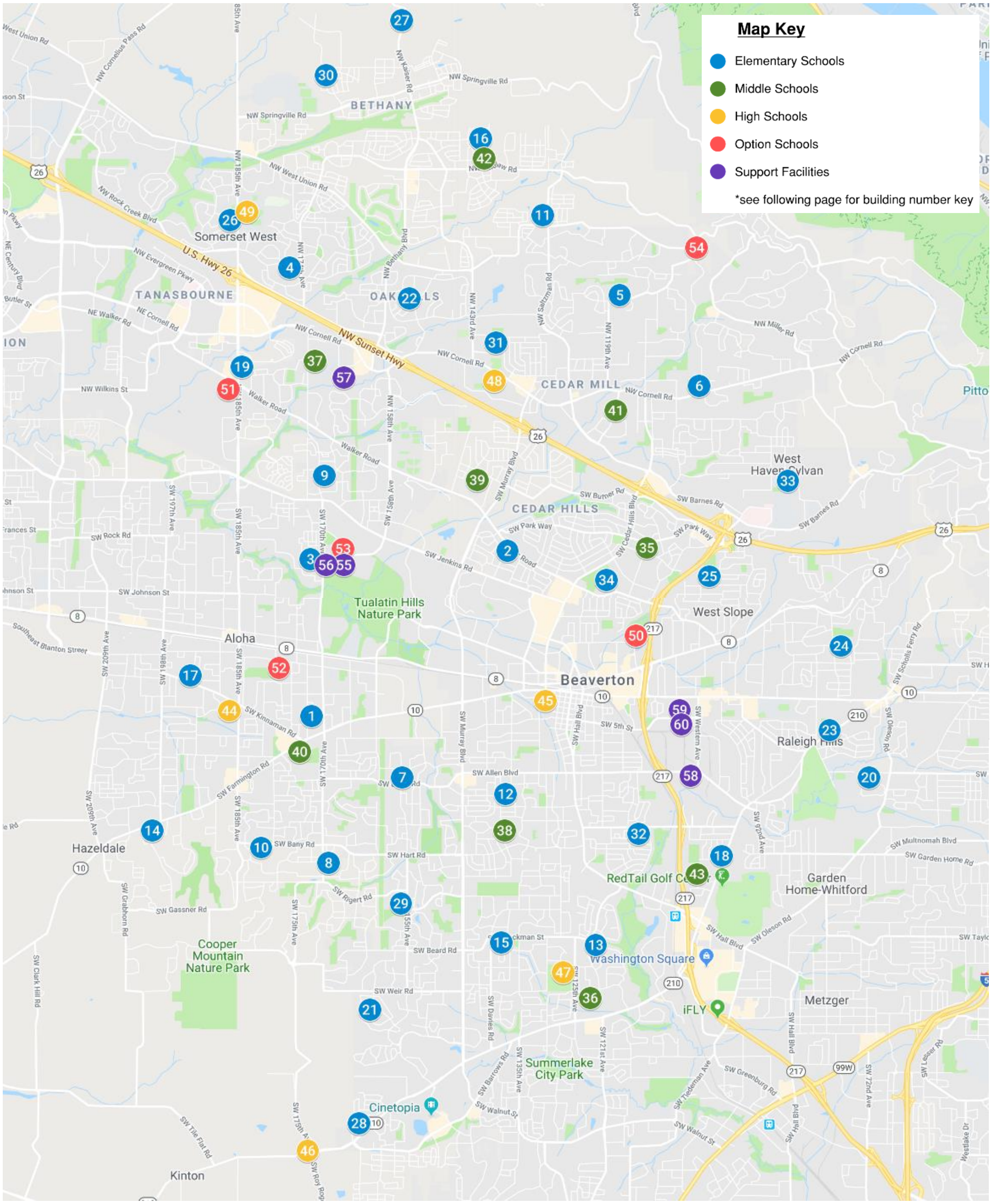

FIGURE 1: MAP

Beaverton School District

Building Key

TYPE	#	CAMPUS NAME
ELEMENTARY SCHOOLS	01	Aloha-Huber Park (K-8)
	02	Barnes
	03	Beaver Acres
	04	Bethany
	05	Bonny Slope
	06	Cedar Mill
	07	Chehalem
	08	Cooper Mountain
	09	Elmonica
	10	Errol Hassell
	11	Findley
	12	Fir Grove
	13	Greenway
	14	Hazeldale
	15	Hiteon
	16	Jacob Wismer
	17	Kinnaman
	18	McKay
	19	McKinley
	20	Montclair
	21	Nancy Ryles
	22	Oak Hills
	23	Raleigh Hills (K-8)
	24	Raleigh Park
	25	Ridgewood
	26	Rock Creek
	27	Sato
	28	Scholls Heights
	29	Sexton Mountain
	30	Springville (K-8)
	31	Terra Linda
	32	Vose
	33	West Tualatin View
	34	William Walker

TYPE	#	CAMPUS NAME
MIDDLE SCHOOLS	35	Cedar Park
	36	Conestoga
	37	Five Oaks
	38	Highland Park
	39	Meadow Park
	40	Mountain View
	41	Timberland
	42	Stoller
	43	Whitford
HIGH SCHOOLS	44	Aloha
	45	Beaverton (with Merle Davies)
	46	Mountainside
	47	Southridge
	48	Sunset
	49	Westview
OPTION SCHOOLS	50	Arts & Communication ACMA
	51	Capital Center - Health & Science
	52	International School ISB
	53	Merlo Station Community High
	54	Terra Nova School of Science &
SUPPORT FACILITIES	55	Administration Building
	56	Maintenance Building
	57	Transportation Main
	58	Transportation Allen
	59	Transportation 5th St. North
	60	Transportation 5th St. South

Results

The ASCE 41-13 performance standards are listed below in order of highest performance to lowest performance. Both structural and nonstructural performance objectives are ranked separately, as they are considered separately in ASCE 41.

Structural Performance Objectives:

- S-1: Immediate Occupancy
  - Very limited structural damage has occurred.
  - Risk of life-threatening injury as a result of structural damage is very low.
  - Minor repairs might be required, but not generally to re-occupy.
  - Continued use of the building will not be limited by its structural condition.
- S-2: Damage Control Range (district's goal)
  - Half way between Immediate Occupancy and Life Safety.
- S-3: Life Safety
  - Significant damage to the structure will occur but some margin against partial or total collapse will remain.
  - Some structural elements will be severely damaged, but this damage will not result in large falling debris hazards, either inside or outside the building.
  - Injuries might 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 repair might not be practical.
  - Although the damaged structure may not be an imminent collapse risk, it would be prudent to implement structural repairs or install temporary bracing before re-occupancy.
- S-4: Limited Safety Range
  - Half way between Life Safety and Collapse Prevention.
- S-5: Collapse Prevention
  - Little to no lateral strength or stiffness to resist lateral loads.
  - Large permanent drifts to the building where doors may not open.
  - Structural collapse possible in aftershock events thus not safe to occupy after event.
  - Cost to repair structure will likely outweigh demo/replacement.
- S-6: < Collapse Prevention
  - Possible partial or full collapse of structure.
  - Non-collapsed areas have minimal reserve capacity and significant residual drift.
  - Full structural collapse probable in aftershock or wind event.
  - Building will likely require full demo/rebuild.

Nonstructural Performance Objectives:

- N-A: Operational
  - Cladding: Connections may yield, but no loss of weather tightness.
  - Partitions: Only minor drywall cracking or hairline cracks in CMU.
  - Ceilings: Negligible damage – no loss of functionality.

- Parapets: Only minor damage, no loss of strength or permanent deflections.
  - Doors: Minimal to no damage – all doors remain operational.
- N-B: Position Retention (district's goal)
  - Cladding: Connections may yield with minor cracking and minimal leaks possible.
  - Partitions: Minor cracking in drywall or CMU, limited permanent racking.
  - Ceilings: Minor spalling of ceiling tiles or gyp. Minimal loss of ceiling tiles.
  - Parapets: Minor damage – possible residual deformation.
  - Doors: Minor damage, some doors may stick.
- N-C: Life Safety
  - Cladding: Extensive distortion of cladding system, likely failure of weather tightness. No panels fall off structure.
  - Partitions: Significant cracking/damage including permanent racking, no partitions fall.
  - Ceilings: Likely damage to ceilings system including loss of some panels. Possible damage to adjacent systems due to movement. Egress possibly limited by damage.
  - Parapets: Extensive damage and significant permanent deformation. Possible falling of minor debris. No significant failure/dislodgement.
  - Doors: Damage across all door systems possible. Most doors will stick and some doors may have significant residual deformation causing them to jamb and be unusable.
- N-D: Hazards Reduced
  - Cladding: Extensive distortion of cladding system including possible broken windows and failure of connections to structure.
  - Partitions: Permanent racking of walls including possible failure of bracing connections leading to partial or full failure of walls.
  - Ceilings: Extensive damage to ceiling systems including loss of significant number of tiles and light fixtures. Movement of ceiling could cause extensive damage to adjacent systems.
  - Parapets: Failure of parapets including possible collapse and falling debris.
  - Doors: Damage across door systems likely with significant number of doors being jammed and unusable.
- N-E: < Hazards Reduced
  - Cladding: Damage of the cladding system including possible panels becoming detached from the structure.
  - Partitions: Damage including possible collapse of partitions.
  - Ceilings: Possible full failure of ceiling system including significant falling debris inhibiting egress.
  - Parapets: Significant failure of parapets including likely collapse with falling debris.
  - Doors: Most doors are jammed or extensively damaged due to movement of building. Most if not all doors are unpassable.

The district's goal of Damage Control for the Structural Performance Objective and Position Retention for the Nonstructural Performance Objective meets the ASCE 41-13 Basic Performance Objective for Existing Buildings (BPOE) for Risk Category III buildings, which schools fall under.

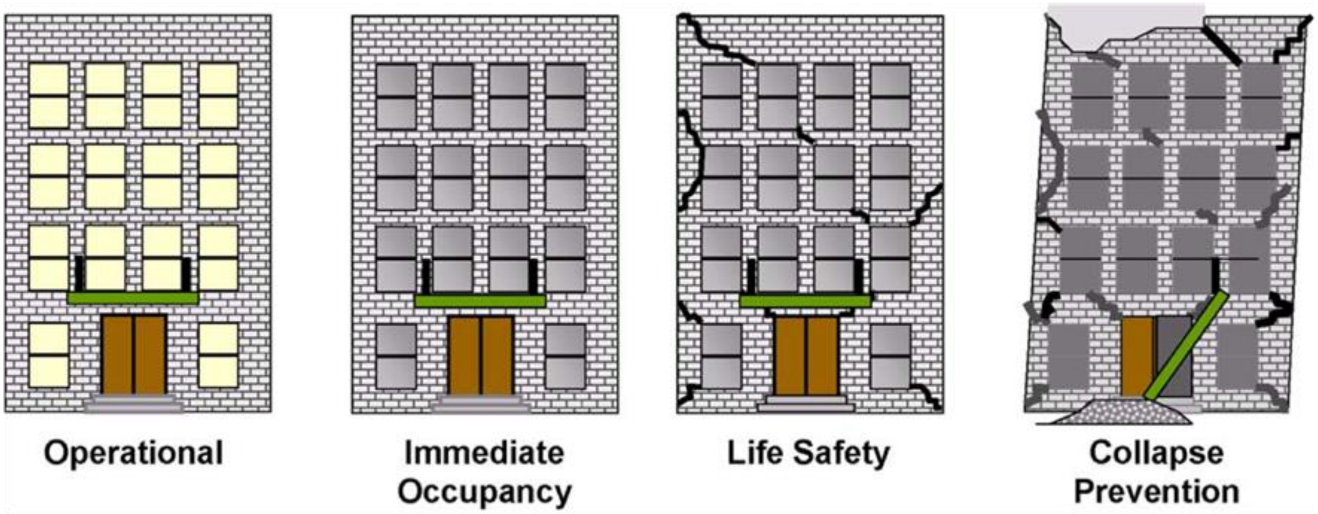

FIGURE 2: EXPECTED DAMAGE PER PERFORMANCE LEVEL

Each campus was given a score based on its seismic vulnerabilities. This score indicates how it would likely perform during a seismic event based on the ASCE 41-13 performance objectives. The scoring ranges are below in Tables 2 and 3.

Structural Performance Objectives and Score Ranges					
S-1	S-2	S-3	S-4	S-5	S-6
Immediate Occupancy	Damage Control Range	Life Safety	Limited Safety Range	Collapse Prevention	< CP
100-91	90-81	80-71	70-61	60-51	50-41

TABLE 2: STRUCTURAL PERFORMANCE OBJECTIVES AND SCORE RANGES

Nonstructural Performance Objectives and Score Ranges				
N-A	N-B	N-C	N-D	N/A
Operational	Position Retention	Life Safety	Hazards Reduced	< Hazards Reduced
100-91	90-81	80-71	70-61	60-51

TABLE 3: NONSTRUCTURAL PERFORMANCE OBJECTIVES AND SCORE RANGES

A structural score of 70 indicates that a building is very close to meeting the LS performance objective, but there are likely minor deficiencies preventing that designation. A structural score below 50 indicates that a portion of a building is seismically vulnerable to collapse. Typically, structural and nonstructural vulnerabilities correlate.

The following figures show the results of each school grouped by campus type. There is a trend line from the top left of the chart to the bottom right. The bubble size indicates the relative probable cost to seismically upgrade the building to the district's standard (Damage Control for the structural performance and Immediate Occupancy for the nonstructural performance).

The district's goal "zone" has been indicated by a green dashed perimeter. The Life Safety "zone" has been indicated by a yellow dashed perimeter. The orange "zone" indicates campuses that scored below Life Safety, but above "Collapse Prevention". The red "zone" indicates campuses that scored below Collapse Prevention.

The probable costs were based on set cost ranges and are shown in Table 4. Each campus was assigned a probable cost "score" based on the expected range of construction costs.

Probable Cost Ranges

$/SF Range	$ Score
$0	0
$1 - 9	5
$10 - 19	15
$20 - 29	25
$30 - 39	35
$40 - 49	45
$50 - 59	55
$60+	65

TABLE 4: PROBABLE COST RANGES

For each campus type, there is a table and figures as listed below on the following pages:

- Table indicating campus structural, nonstructural and probable cost scores.
- Figure showing the structural performance versus nonstructural performance versus probable cost for each campus.
  - The probable cost is indicated by the bubble size shown in Table 4.
  - Figure 3 defines the performance objective zones for this type of chart.
  - Figure 20 shows all 60 campuses on the same chart with campus type indicated by color.
- Figure showing the structural performance versus probable cost for each campus.
  - Figure 4 defines the performance objective zones for this type of chart.
  - Figure 21 shows all 60 campuses on the same chart with each campus type indicated by color.
- Figure showing the probable cost for each campus.

A few notes to keep in mind when reviewing the scores:

- 02: Barnes ES – The 2007 addition brought down the $/SF range based on overall SF. The $/SF cost of the original building would be in the $45/SF range.
- 17: Kinnaman ES – It was unclear if the CMU wall in the play area was reinforced. This stood out to be a deficiency that could be easily addressed.
- 25: Ridgewood – The most significant repair for this school would be out-of-plane bracing for gymnasium walls, corridors and end classroom wing walls.
- 36: Conestoga ES – The cost for this school mainly accounts for blocking of the diaphragm. Further analysis might prove this school to meet the Damage Control objective as is.
- 37: Five Oaks ES – The most significant repair for this school would be wall to roof diaphragm connections.
- 38 Highland Park MS, 39: Meadow Park MS and 43: Whitford MS – A significant stand-alone repair for these schools would be to strengthen or just replace the entry canopies.
- 40: Mountain View MS – Replacing/strengthening of the tectum roof in the gym should be the priority at this school.
- 45: Beaverton HS – The $/SF number at this school is based on a large overall building square footage. There is a significant portion of the building with $/SF costs that would be higher than the $65/SF range.
- 51: Capital Center – The most significant repair for this building would be strengthening of the in-plane shear connections from the diaphragm to the concrete shear walls.
- 52: International School ISB – The most significant repair for this building would be strengthening the URM parapets around the old front entry and the roof trusses in the gymnasium. The 2005 addition brought down the $/SF range based on overall SF. The $/SF cost of the previous additions would be in the $45/SF range.
- 54: Terra Nova School of Science & Sustainability – The most significant repair for this building would be strengthening the out-of-plane walls at the gymnasium.

We found the lowest performing schools (either holistically or partially, starting with the lowest) to be:

- 33: West Tualatin View ES – This school has a gymnasium that is supported by concrete pilasters with single wythe unreinforced masonry infill. The masonry infill is a falling hazard during a seismic event.
- 45: Beaverton HS – A considerable portion of this school is URM. There have also been a number of undocumented additions to the original building causing the probable cost estimate risk to be relatively high.
- 23: Raleigh Hills (K-8) – This school has many additions and alterations with multiple deficiencies.
- 12: Fir Grove ES – This school lacks shear walls and contains unbraced/unanchored masonry walls that need bracing.
- 52: International School ISB – This school has many additions and alterations with multiple deficiencies.
- 18: McKay ES – This school has many additions and alterations with multiple deficiencies.
- 24: Raleigh Park – This school stood out to have a significant hazard since most interior corridor walls were CMU that do not extend to the roof diaphragm. The Tectum roof diaphragm has been mostly strengthened, but there are a number of interior falling hazards from heavy walls that are unbraced.
- 35: Cedar Park MS, 38: Highland Park MS, 40: Mountain View MS and 43: Whitford MS – These schools are almost identical. While some have been partially seismically upgraded, they still contain significant deficiencies particularly around the concrete gymnasium, cafeteria and wrestling rooms. The classroom wings do not have shear walls.

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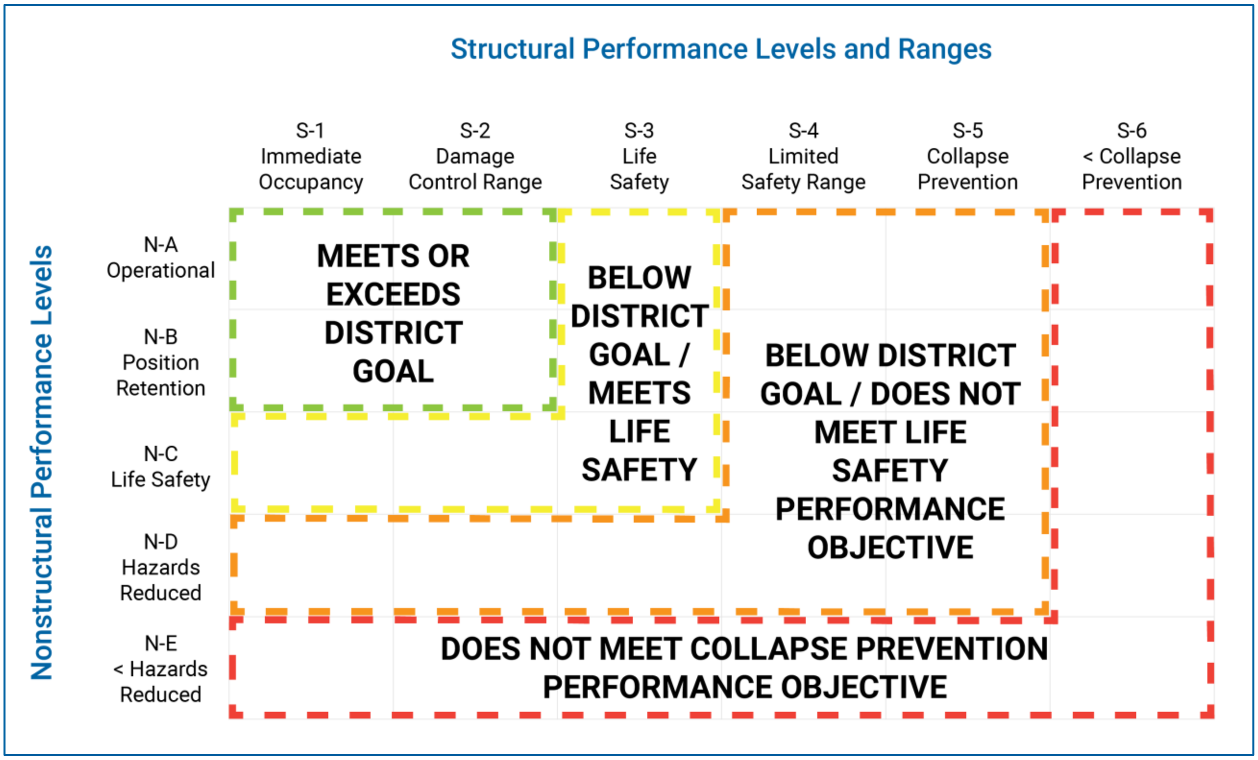

FIGURE 3: STRUCTURAL VS. NONSTRUCTURAL VS. PROBABLE COST ZONES

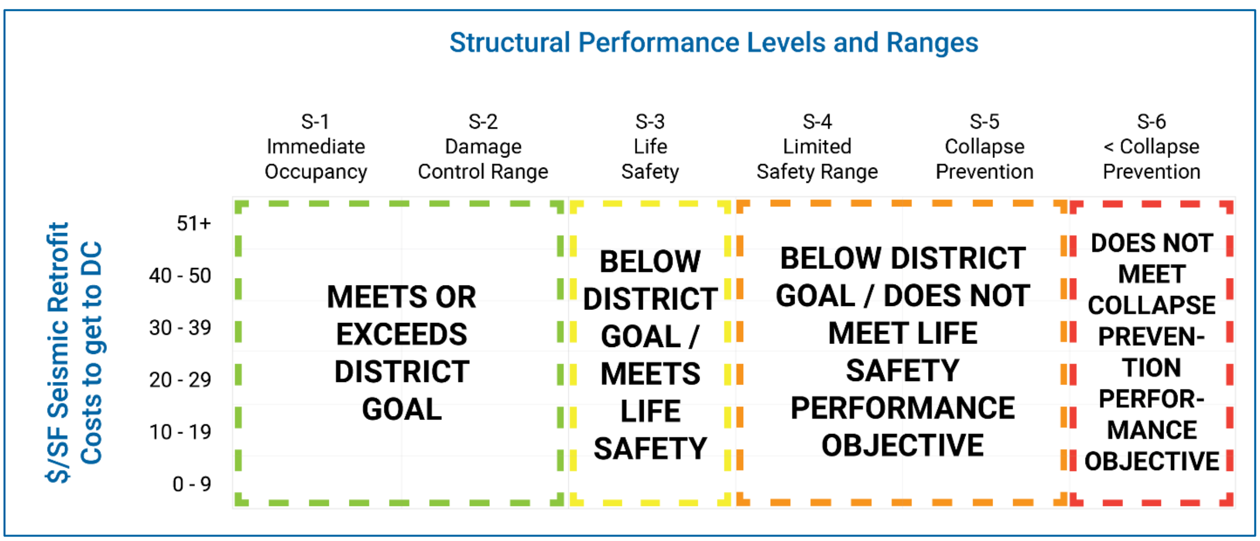

FIGURE 4: STRUCTURAL VS. PROBABLE COST ZONES

TYPE	#	Facility Name	Structural Score	Nonstructural Score	$/SF to get to District's Goal
ELEMENTARY SCHOOLS	01	Aloha-Huber Park (K-8)	80	75	5
	02	Barnes	51	61	25
	03	Beaver Acres	52	61	45
	04	Bethany	58	60	35
	05	Bonny Slope	80	75	5
	06	Cedar Mill	55	63	55
	07	Chehalem	67	66	25
	08	Cooper Mountain	64	67	45
	09	Elmonica	62	63	25
	10	Errol Hassell	65	63	25
	11	Findley	68	78	15
	12	Fir Grove	48	55	35
	13	Greenway	63	63	25
	14	Hazeldale	95	95	0
	15	Hiteon	62	65	25
	16	Jacob Wismer	70	70	5
	17	Kinnaman	66	65	25
	18	McKay	49	59	35
	19	McKinley	52	62	35
	20	Montclair	69	65	15
	21	Nancy Ryles	67	78	25
	22	Oak Hills	69	66	15
	23	Raleigh Hills (K-8)	47	58	45
	24	Raleigh Park	50	61	45
	25	Ridgewood	56	61	25
	26	Rock Creek	66	66	25
	27	Sato	95	95	0
	28	Scholls Heights	69	78	15
	29	Sexton Mountain	67	72	35
	30	Springville (K-8)	85	85	0
	31	Terra Linda	69	66	25
	32	Vose	95	95	0
	33	West Tualatin View	45	52	45
	34	William Walker	95	95	0

TABLE 5: ELEMENTARY SCHOOL CAMPUS SCORES

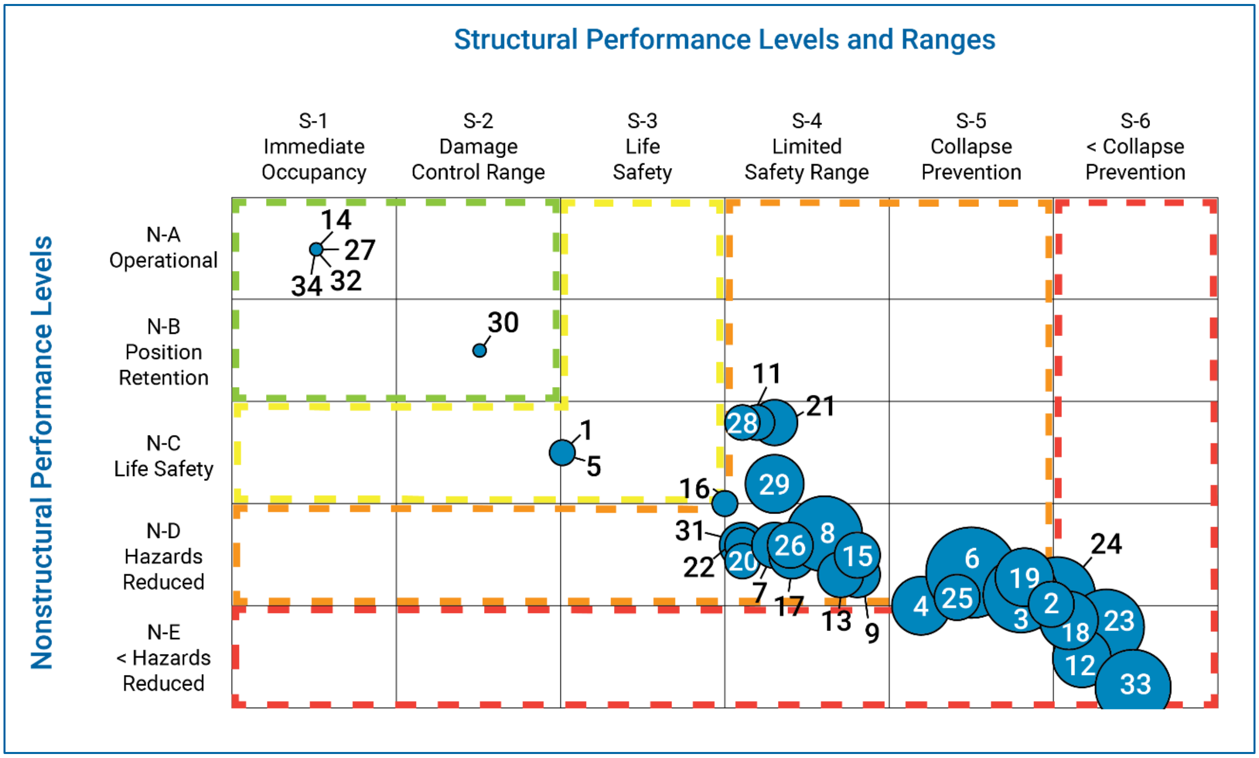

FIGURE 5: ELEMENTARY SCHOOLS
STRUCTURAL VS. NONSTRUCTURAL VS. PROBABLE COST

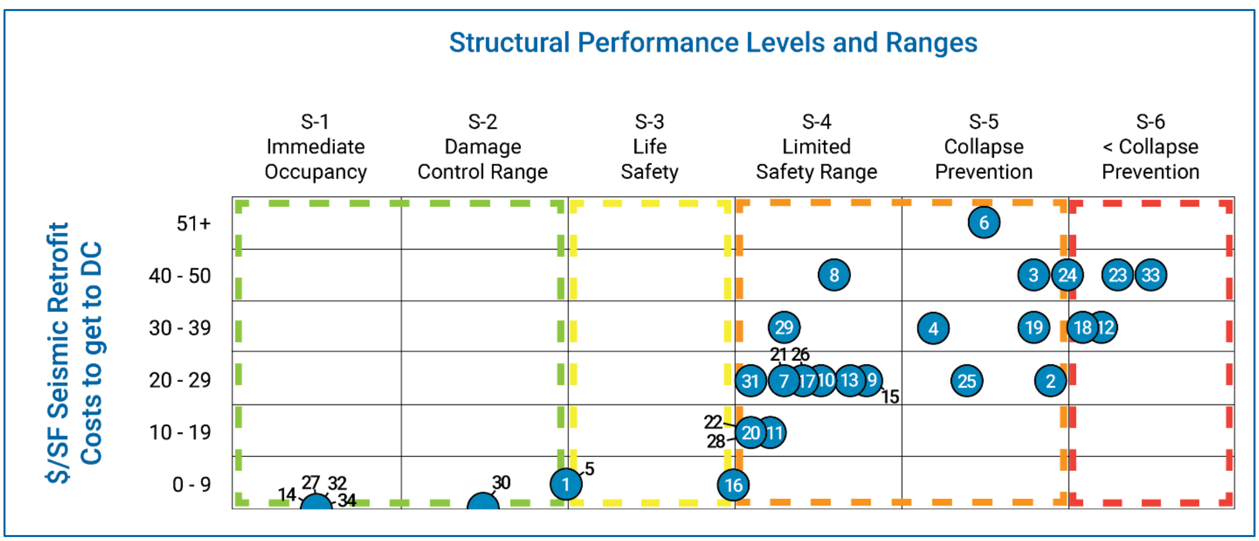

FIGURE 6: ELEMENTARY SCHOOLS
STRUCTURAL VS. PROBABLE COST

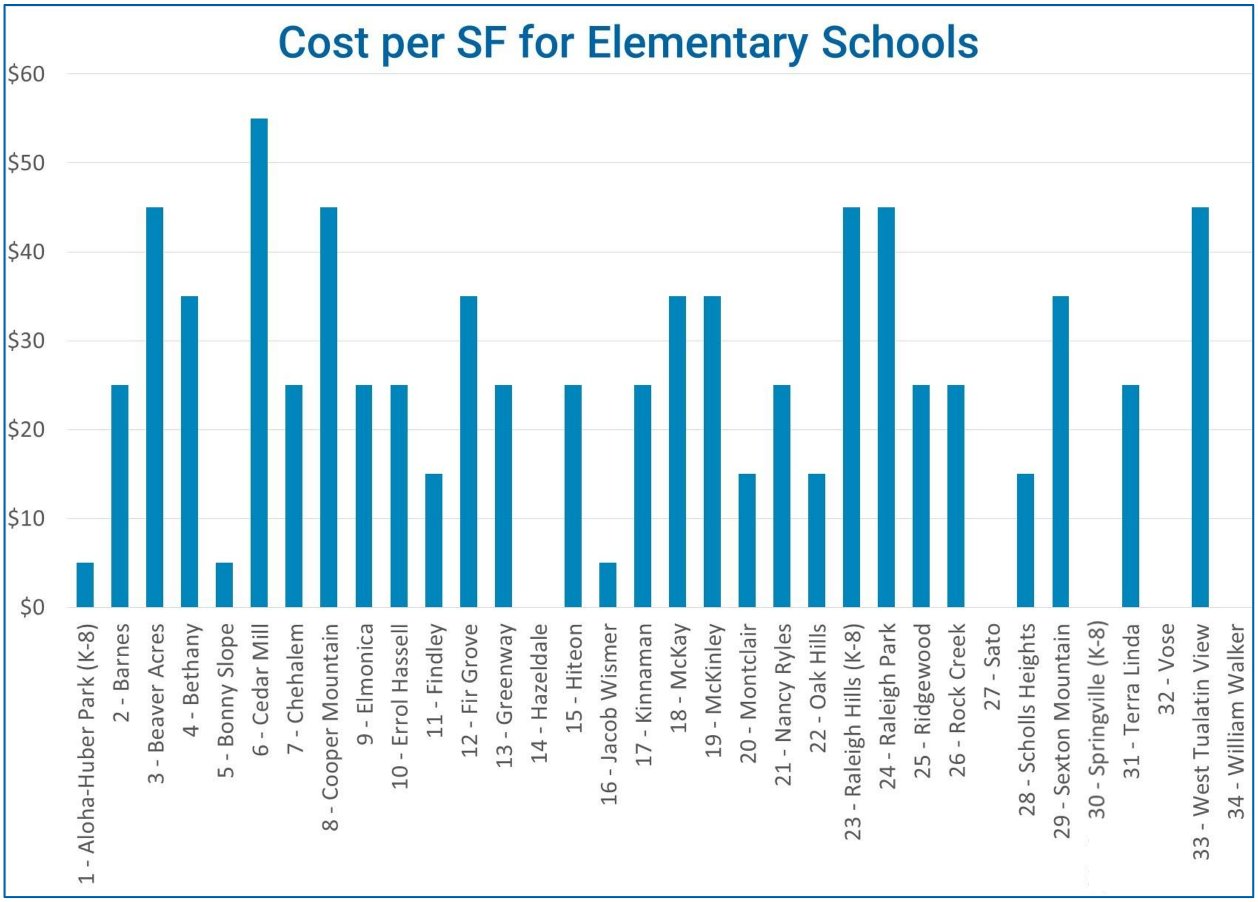

FIGURE 7: ELEMENTARY SCHOOLS PROBABLE COST

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TYPE	#	Facility Name	Structural Score	Nonstructural Score	$/SF to get to District's Goal
MIDDLE SCHOOLS	35	Cedar Park	50	65	45
	36	Conestoga	70	78	25
	37	Five Oaks	55	62	35
	38	Highland Park	50	65	45
	39	Meadow Park	54	65	35
	40	Mountain View	50	65	35
	41	Timberland	95	95	0
	42	Stoller	70	78	25
	43	Whitford	50	65	45

TABLE 6: MIDDLE SCHOOL CAMPUS SCORES

FIGURE 8: MIDDLE SCHOOLS PROBABLE COST

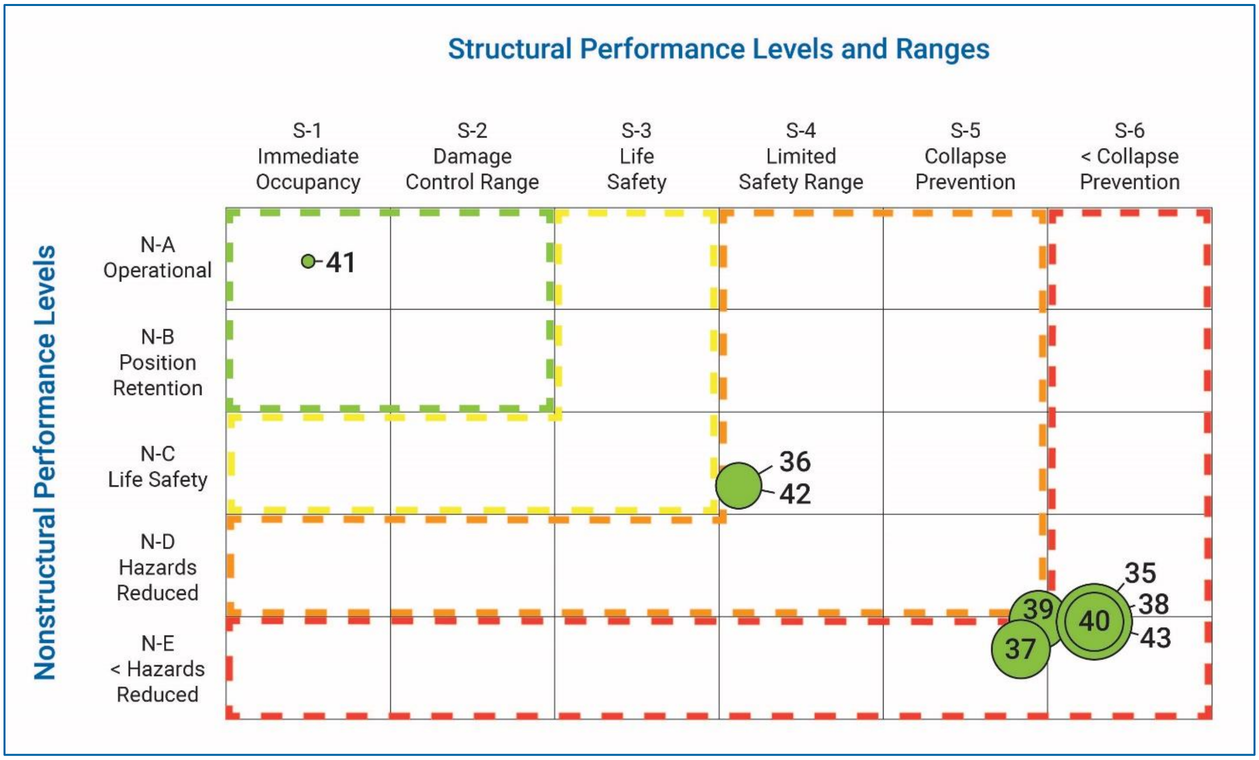

FIGURE 9: MIDDLE SCHOOLS
STRUCTURAL VS. NONSTRUCTURAL VS. PROBABLE COST

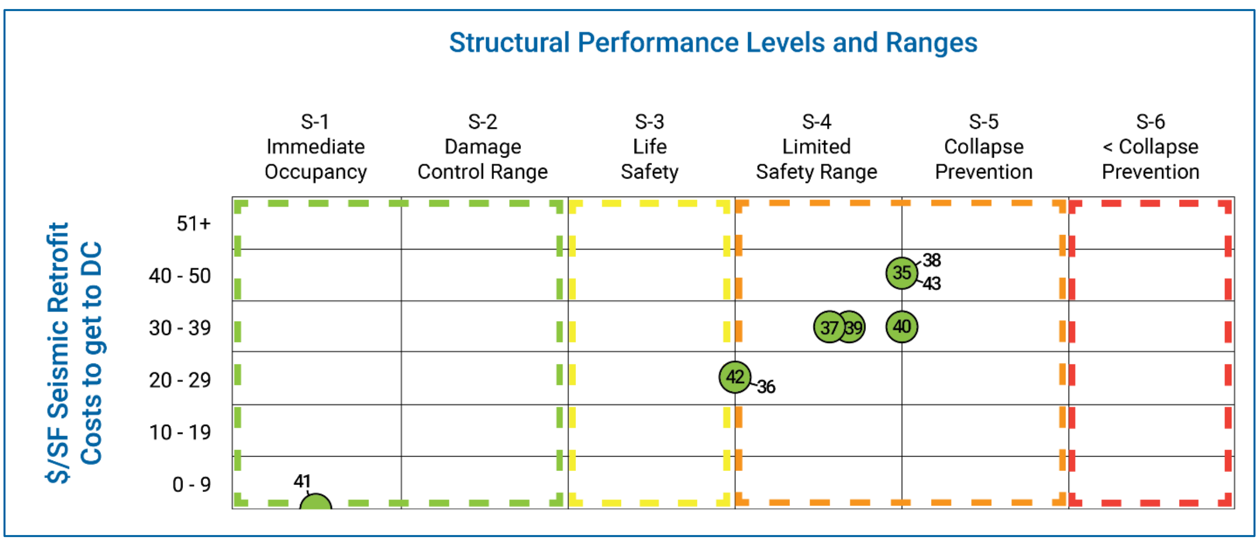

FIGURE 10: MIDDLE SCHOOLS
STRUCTURAL VS. PROBABLE COST

TYPE	#	Facility Name	Structural Score	Nonstructural Score	$/SF to get to District's Goal
HIGH SCHOOLS	44A	Aloha	63	65	25
	45A	Beaverton High School (Main)	45	60	65
	45B	Beaverton High School (Cafeteria)	75	75	15
	45C	Merle Davies	69	69	15
	46	Mountainside	95	95	0
	47	Southridge	70	70	15
	48	Sunset	55	55	55
	49	Westview	68	68	25

TABLE 7: HIGH SCHOOL CAMPUS SCORES

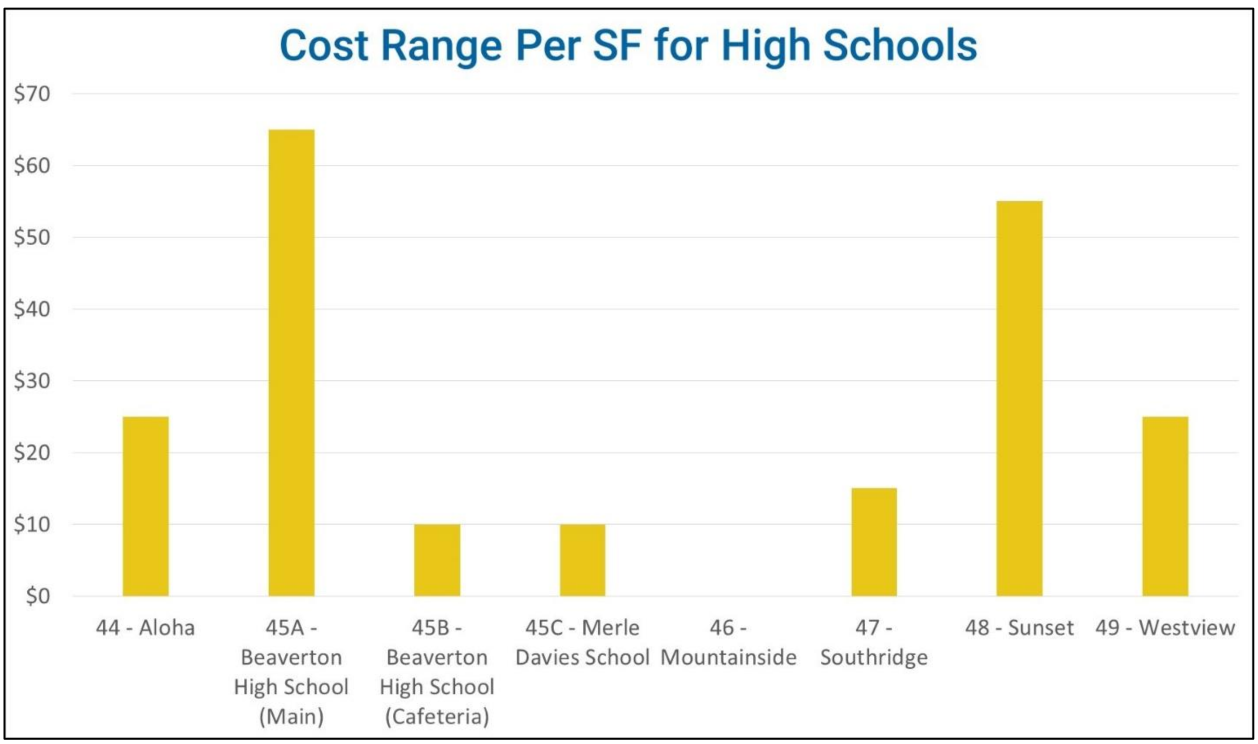

FIGURE 11: HIGH SCHOOLS PROBABLE COST

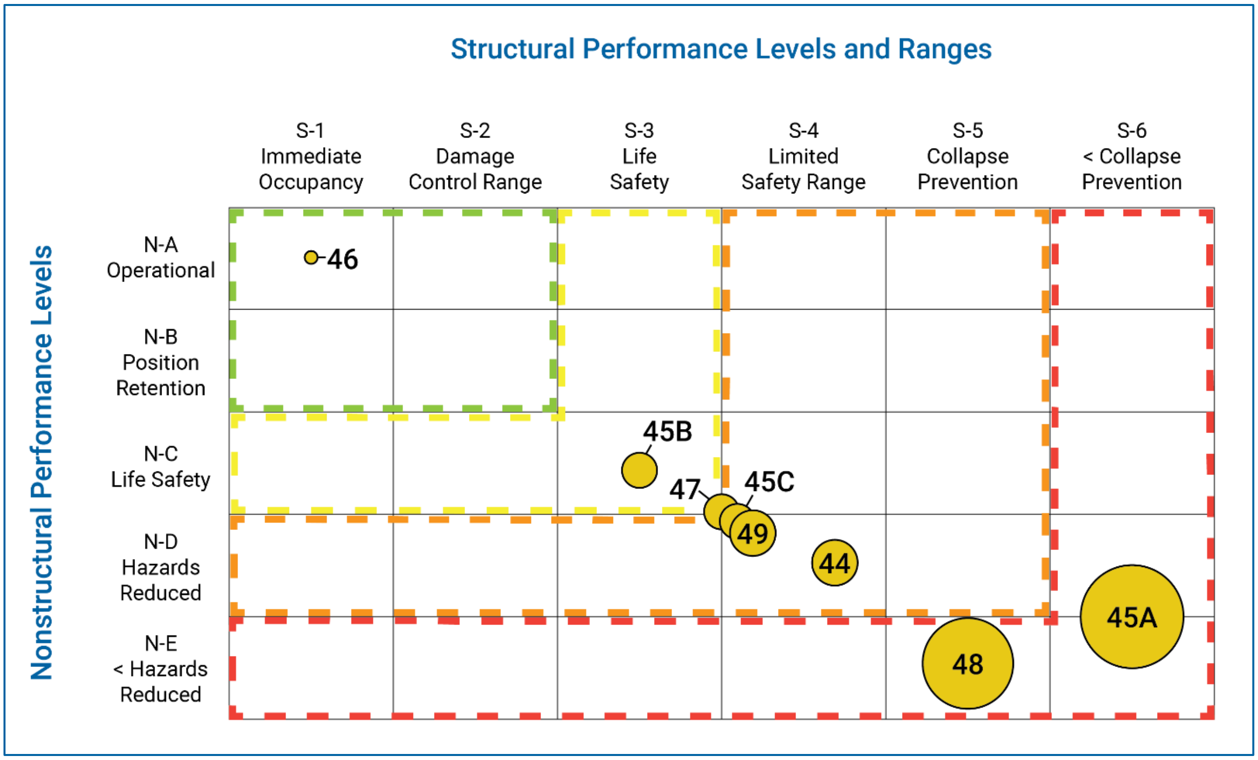

FIGURE 12: HIGH SCHOOLS
STRUCTURAL VS. NONSTRUCTURAL VS. PROBABLE COST

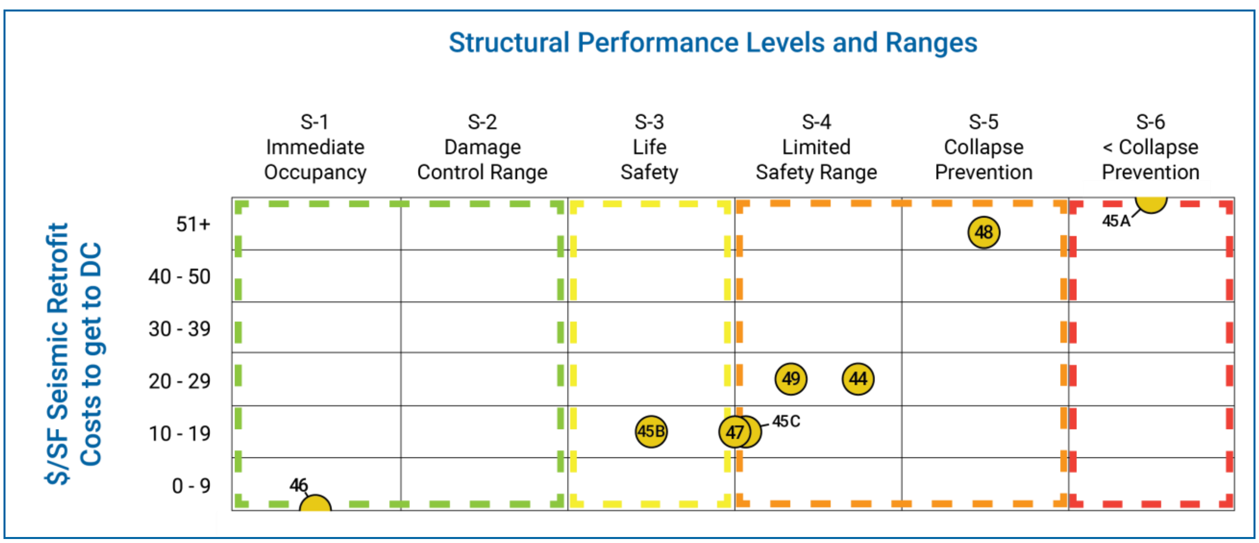

FIGURE 13: HIGH SCHOOLS
STRUCTURAL VS. PROBABLE COST

TYPE	#	Facility Name	Structural Score	Nonstructural Score	$/SF to get to District's Goal
OPTION SCHOOLS	50A	Arts & Communication ACMA (Main Building)	95	95	0
	50B	ACMA (Performing Arts Building)	85	85	0
	51	Capital Center - Health & Science School	58	60	15
	52	International School ISB	48	58	35
	53	Merlo Station Community High	69	65	15
	54	Terra Nova School of Science & Sustainability	62	55	45

TABLE 8: OPTION SCHOOL CAMPUS SCORES

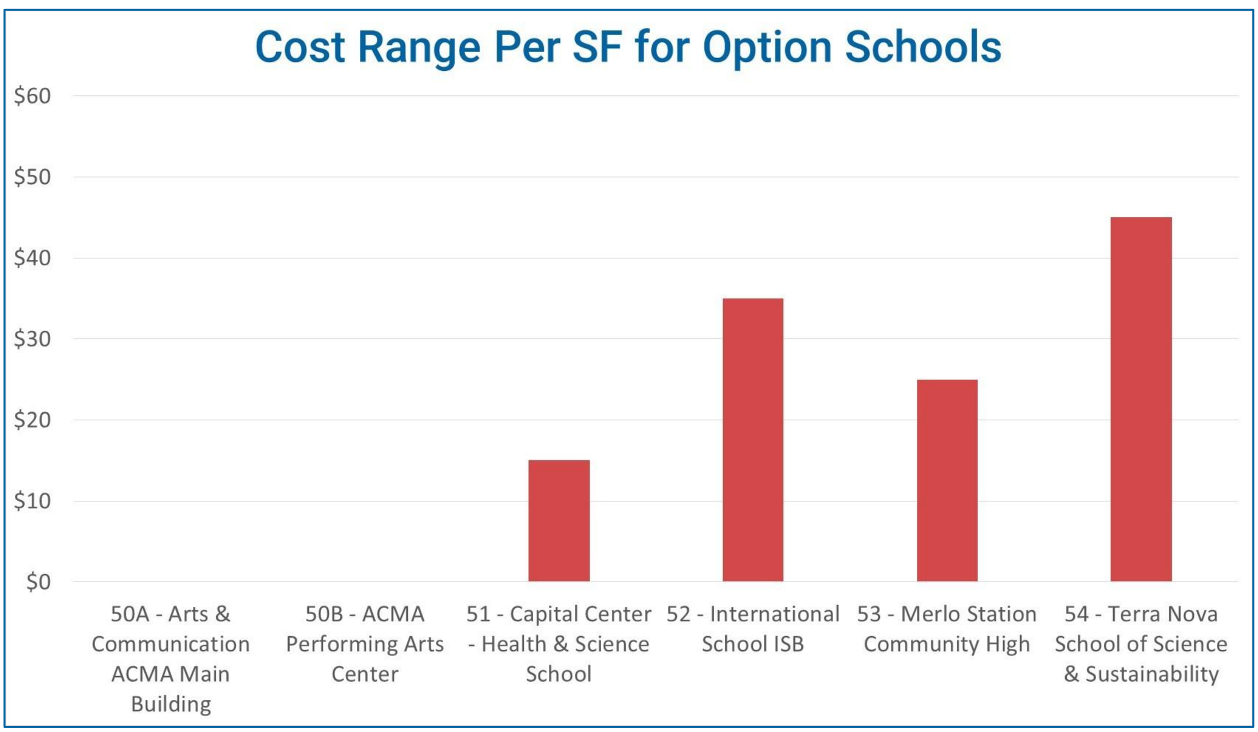

FIGURE 14: OPTION SCHOOLS PROBABLE COST

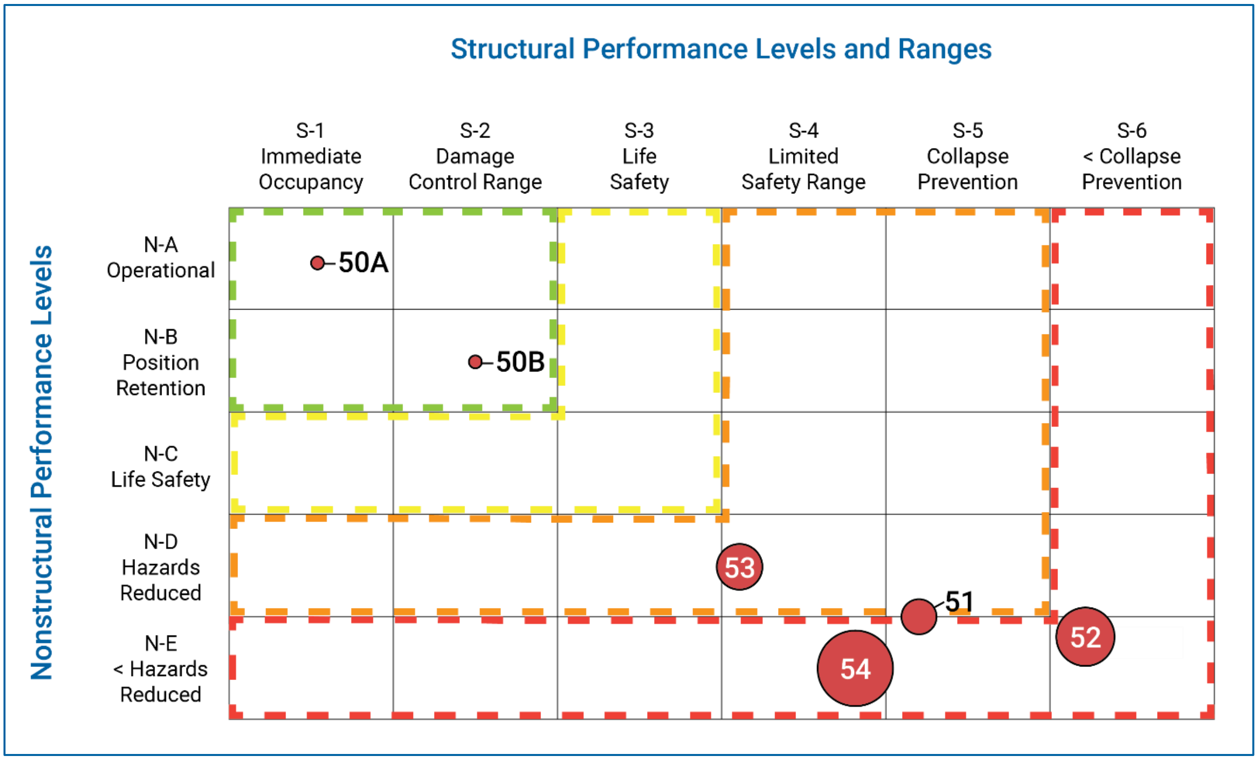

FIGURE 15: OPTION SCHOOLS
STRUCTURAL VS. NONSTRUCTURAL VS. PROBABLE COST

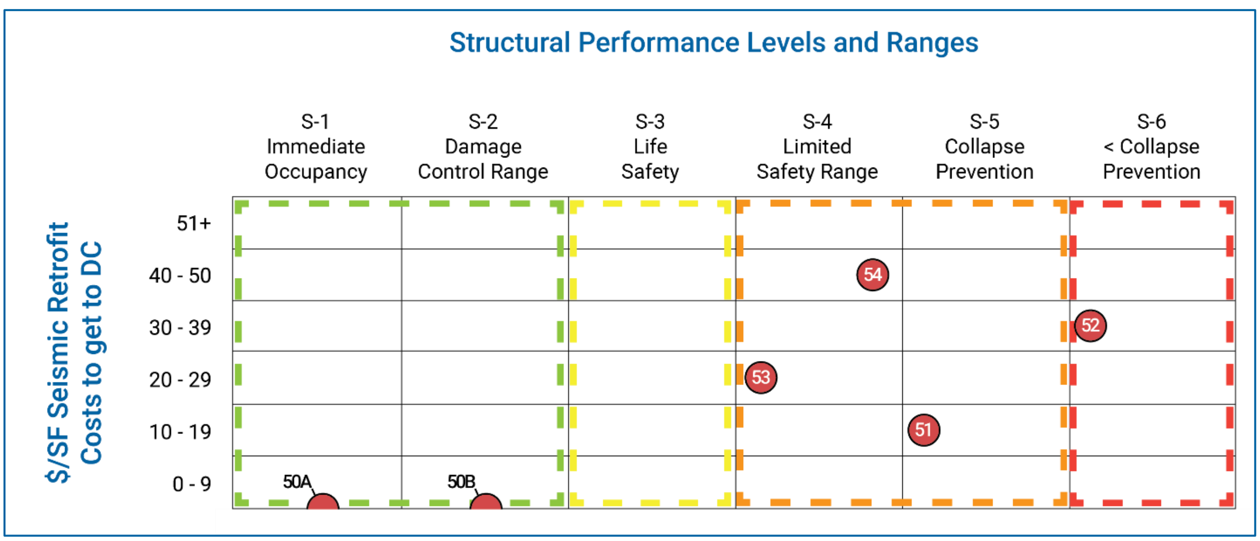

FIGURE 16: OPTION SCHOOLS
STRUCTURAL VS. PROBABLE COST

TYPE	#	Facility Name	Structural Score	Nonstructural Score	$/SF to get to District's Goal
SUPPORT FACILITIES	55	Administration Building	68	66	25
	56	Maintenance Building	67	60	25
	57	Transportation Main	67	61	15
	58	Transportation Allen	58	69	25
	59	Transportation 5th St. North	68	69	15
	60	Transportation 5th St. South	58	68	25

TABLE 9: SUPPORT FACILITY CAMPUS SCORES

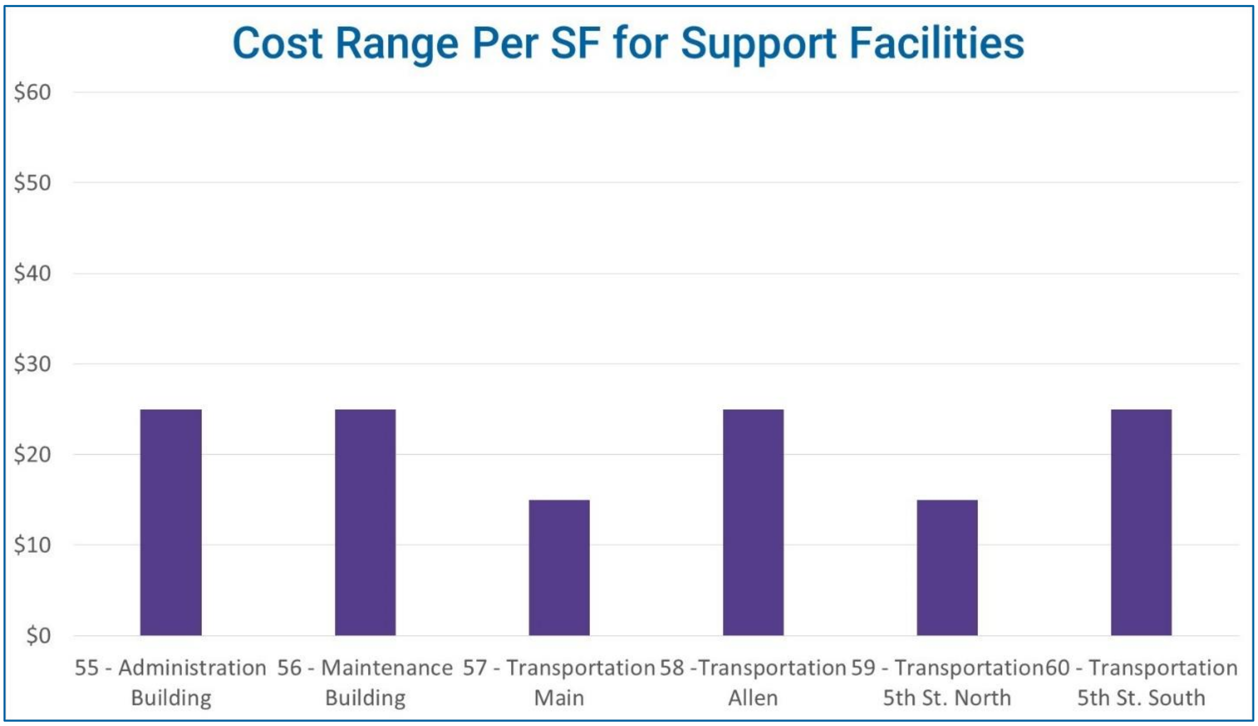

FIGURE 17: SUPPORT FACILITIES PROBABLE COST

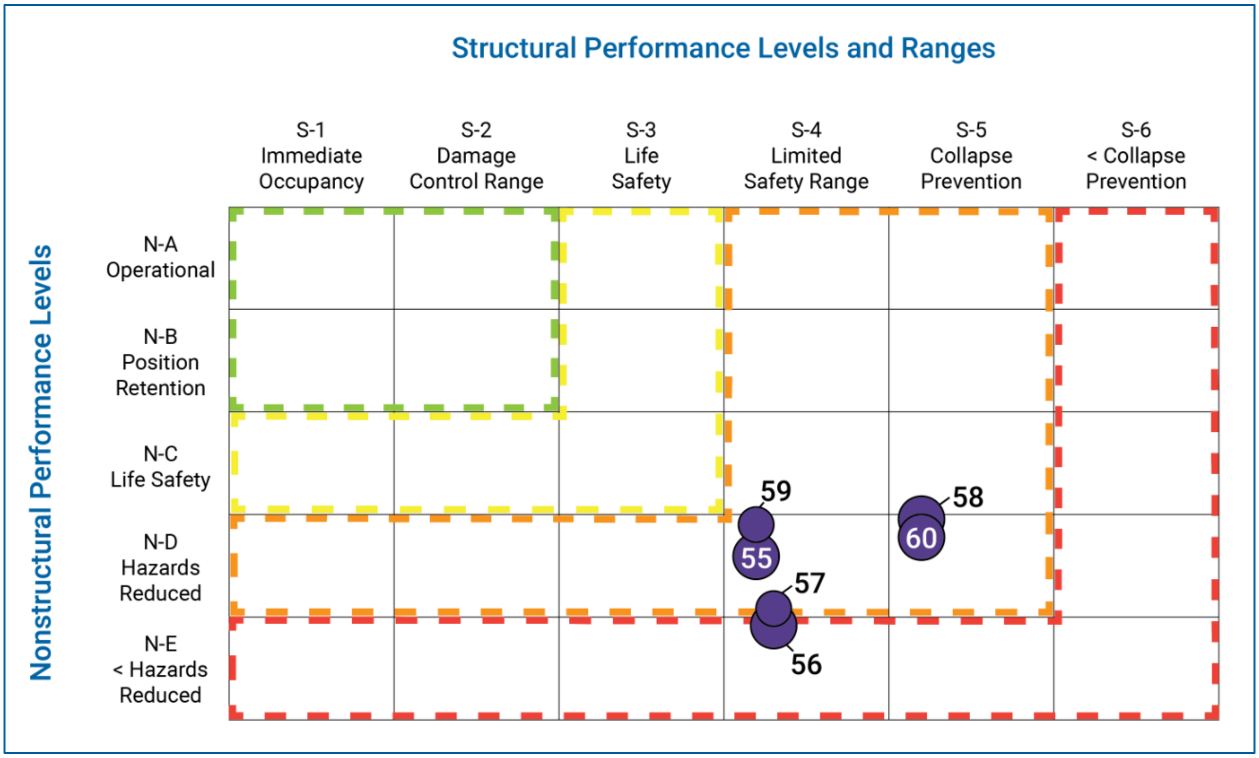

FIGURE 18: SUPPORT FACILITIES
STRUCTURAL VS. NONSTRUCTURAL VS. PROBABLE COST

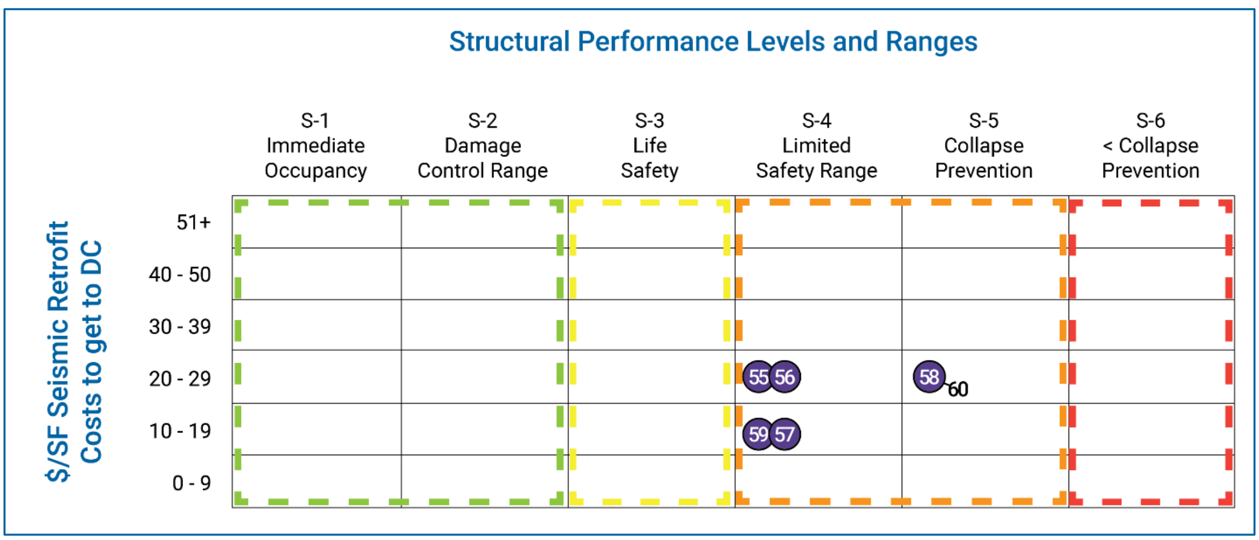

FIGURE 19: SUPPORT FACILITIES
STRUCTURAL VS. PROBABLE COST

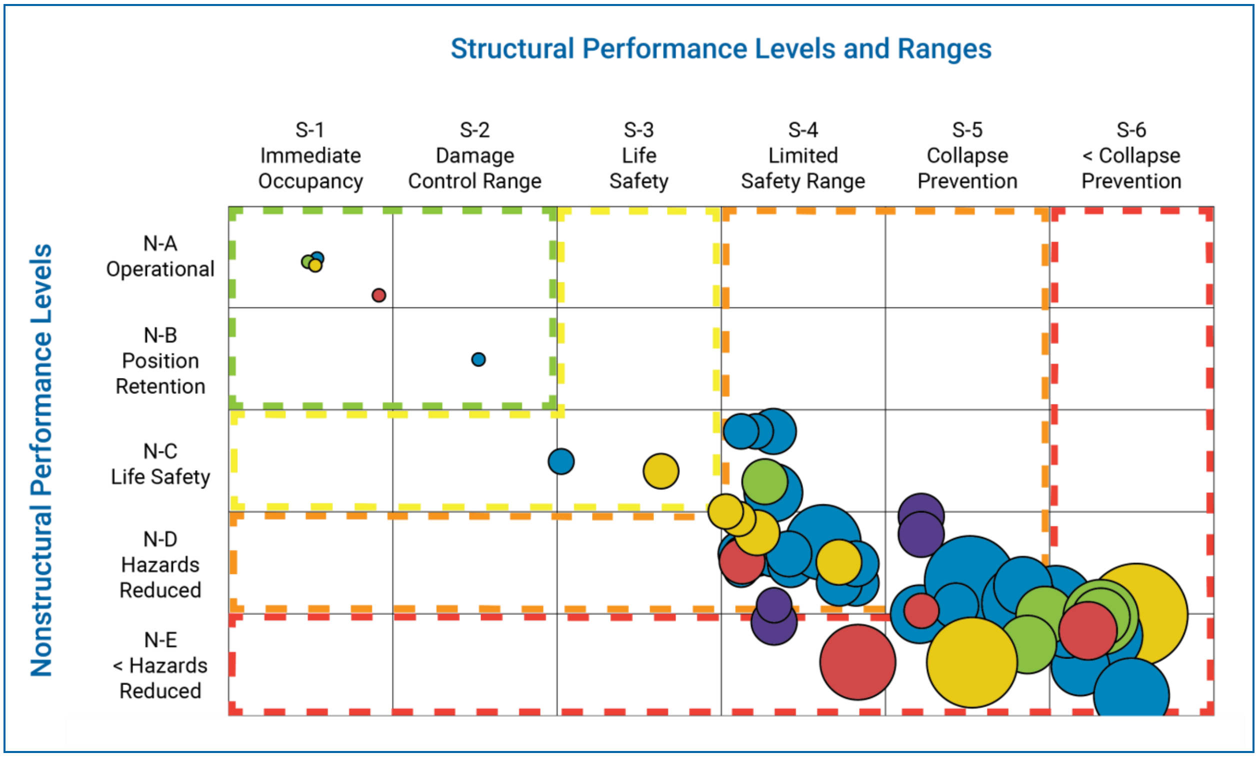

FIGURE 20: ALL CAMPUSES
STRUCTURAL VS. NONSTRUCTURAL VS. PROBABLE COST

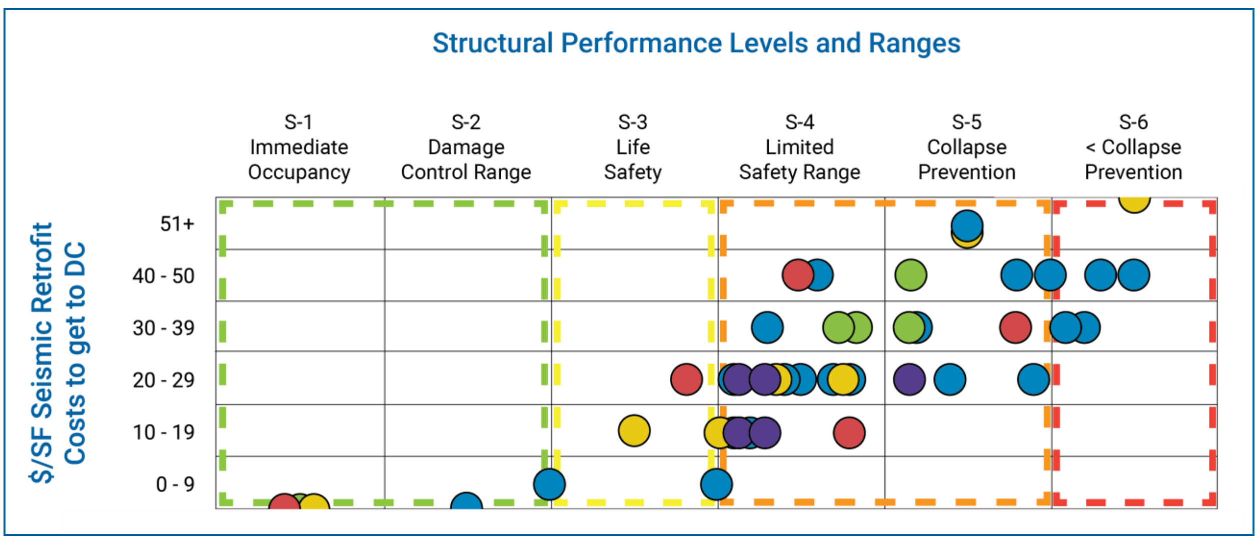

FIGURE 21: ALL CAMPUSES
STRUCTURAL VS. PROBABLE COST

Tables 10 through 13 group the facilities based on the structural performance scores into the four performance zones:

- **Red Zone:** Less than Collapse Prevention Performance Level
- **Orange Zone:** Limited Safety Range & Collapse Prevention Performance Level
- **Yellow Zone:** Life Safety Performance Level
- **Green Zone:** District's Goal Zone - Damage Control Range & Immediate Occupancy Performance Level

The following tables indicate the $/SF costs (as shown in previous tables), the facility square footage and the total cost to reach the district goal. It is important reiterate the following about the $/SF and total costs indicated below:

- The $/SF costs assume that seismic rehabilitation is not occurring in conjunction with other upgrade work and includes an allotment for repairing architectural finishes after the structural work is complete.
- These costs are based on previous seismic rehabilitation studies of other campuses of similar building construction types and ages and do **NOT** include escalation past 2018/2019.
- These estimates are **NOT** fully developed cost estimates and are intended to provide the Beaverton School District with a ROUGH estimate of probable costs.
- These estimates do **NOT** include soft costs that could be up to an additional +/- 30%.
- These estimates do **NOT** include other MEP or architectural upgrades that might occur during a seismic rehabilitation project.

	School #	Facility Name	Structural Score	$/SF *	Square Footage	Total $ to get to District's Goal *
< Collapse Prevention	33	West Tualatin View	45	45	43,447	$ 1,955,115
	45A	Beaverton HS (Main Building)	45	65	233,844	$ 15,199,860
	23	Raleigh Hills (K-8)	47	45	56,647	$ 2,549,115
	12	Fir Grove	48	35	60,666	$ 2,123,310
	52	International School ISB	48	35	75,585	$ 2,645,475
	18	McKay	49	35	48,736	$ 1,705,760
	24	Raleigh Park	50	45	45,166	$ 2,032,470
	35	Cedar Park	50	45	117,054	$ 5,267,430
	38	Highland Park	50	45	116,892	$ 5,260,140
	40	Mountain View	50	35	133,942	$ 4,687,970
	43	Whitford	50	45	116,962	$ 5,263,290
					Total for < Collapse Prevention Campuses =	**$ 48,689,935**

TABLE 10: < Collapse Prevention Costs
***Reference cost estimate notes on this page**

	School #	Facility Name	Structural Score	$/SF *	Square Footage	Total $ to get to District's Goal *
Limited Safety Range & Collapse Prevention	02	Barnes	51	25	75,900	$ 1,897,500
	03	Beaver Acres	52	45	79,507	$ 3,577,815
	19	McKinley	52	35	61,265	$ 2,144,275
	39	Meadow Park	54	35	116,682	$ 4,083,870
	06	Cedar Mill	55	55	41,055	$ 2,258,025
	37	Five Oaks	55	35	143,039	$ 5,006,365
	48	Sunset	55	55	253,727	$ 13,954,985
	25	Ridgewood	56	25	54,059	$ 1,351,475
	04	Bethany	58	35	49,913	$ 1,746,955
	51	Capital Center	58	15	105,883	$ 1,588,245
	58	Transportation Allen	58	25	9,779	$ 244,475
	60	Transportation 5th St. South	58	25	25,800	$ 645,000
	09	Elmonica	62	25	50,734	$ 1,268,350
	15	Hiteon	62	25	78,972	$ 1,974,300
	54	Terra Nova School	62	45	11,800	$ 531,000
	13	Greenway	63	25	54,991	$ 1,374,775
	44	Aloha	63	25	260,677	$ 6,516,925
	08	Cooper Mountain	64	45	54,821	$ 2,466,945
	10	Errol Hassell	65	25	60,345	$ 1,508,625
	17	Kinnaman	66	25	80,837	$ 2,020,925
	26	Rock Creek	66	25	51,505	$ 1,287,625
	07	Chehalem	67	25	54,316	$ 1,357,900
	21	Nancy Ryles	67	25	71,119	$ 1,777,975
	29	Sexton Mountain	67	35	67,318	$ 2,356,130
	56	Maintenance Building	67	25	21,390	$ 534,750
	57	Transportation Main	67	15	47,000	$ 705,000
	11	Findley	68	15	72,052	$ 1,080,780
	49	Westview	68	25	281,183	$ 7,029,575
	55	Administration Building	68	25	35,995	$ 899,875
	59	Transportation 5th St. North	68	15	5,139	$ 77,085
	20	Montclair	69	15	38,526	$ 577,890
	22	Oak Hills	69	15	49,890	$ 748,350
	28	Scholls Heights	69	15	68,941	$ 1,034,115
	31	Terra Linda	69	25	51,636	$ 1,290,900
	45C	Merle Davies	69	15	39,000	$ 585,000
	53	Merlo Station High	69	25	51,125	$ 1,278,125
	16	Jacob Wismer	70	5	72,863	$ 364,315
	36	Conestoga	70	25	128,179	$ 3,204,475
	42	Stoller	70	25	143,788	$ 3,594,700
	47	Southridge	70	15	256,070	$ 3,841,050
		Total for Limited Safety & Collapse Prevention Range =				**$ 89,786,445**

TABLE 11: Limited Safety Range & Collapse Prevention Costs

***Reference cost estimate notes on Page 29**

	School #	Facility Name	Structural Score	$/SF *	Square Footage	Total $ to get to District's Goal *
Life Safety	01	Aloha-Huber Park (K-8)	80	5	106,046	$ 530,230
	05	Bonny Slope	80	5	80,405	$ 402,025
	45B	Beaverton HS (Cafeteria)	75	15	30,172	$ 452,580
					Total for Life Safety Range =	**$ 1,384,835**

TABLE 12: Life Safety Costs

***Reference cost estimate notes on Page 29**

	School #	Facility Name	Structural Score	$/SF	Square Footage	Total $ to get to District's Goal
Damage Control Range & Immediate Occupancy	30	Springville (K-8)	85	**These schools meet the District's Goal and do not need to be seismically retrofitted.**		
	50A	Arts & Communication ACMA (Main Building)	95			
	50B	ACMA (Performing Arts Building)	85			
	14	Hazeldale	95			
	27	Sato	95			
	32	Vose	95			
	34	William Walker	95			
	41	Timberland	95			
	46	Mountainside	95			
	Total for Damage Control Range & Immediate Occupancy =					**$ 0**

TABLE 13: Damage Control Range & Immediate Occupancy Costs

Total to meet District’s Goal = $ 139,861,215

***Reference cost estimate notes on Page 29**

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Campus Reports

Seismic Assessment Summary per Campus

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01: Aloha-Huber (K-8) School

Building Summary and Building Year Plan

The Aloha-Huber School is a two-story structure built in 2005. The lateral force-resisting system is comprised of Special Concentrically Braced Frames, SCBF (S2) at the classroom wing and reinforced masonry shear walls (RM1) at the gym wing. The roof diaphragm is 1½" metal deck across the entire structure. The second floor diaphragm is composite metal deck with reinforced concrete topping. Both diaphragms tie into the lateral force-resisting system elements with in-plane and out-of-plane connections.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The 2005 school has two wings. The northern wing consists of an administration area, commons area, and classrooms across a two-story structure. The southern wing has a gymnasium and outdoor covered play area. Gravity elements are made up of steel framing with brick veneer at the northern wing. Reinforced masonry walls with steel roof joists support gravity loads at the gymnasium area. Foundations consist of reinforced concrete strip footings at the exterior and column footings at all interior and exterior columns. The floor system consists of a reinforced concrete slab-on-grade with connections back to foundations. The lateral force-resisting system consists of an SCBF system and reinforced masonry walls at each wing respectively. The roof diaphragm for each wing consists of normal and acoustical metal decking. The second floor diaphragm is composite metal deck with reinforced concrete topping.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District, which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- The original building structure was designed with a seismic importance factor of 1.25, which is roughly equivalent to the Damage Control Performance Level.
- Since this building was constructed, braced frame detailing requirements have changed and now require cover plates at the brace to gusset plate connections. These braces do not have these plates and require strengthening to meet current performance requirements.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown but are likely not a deficiency for this site.

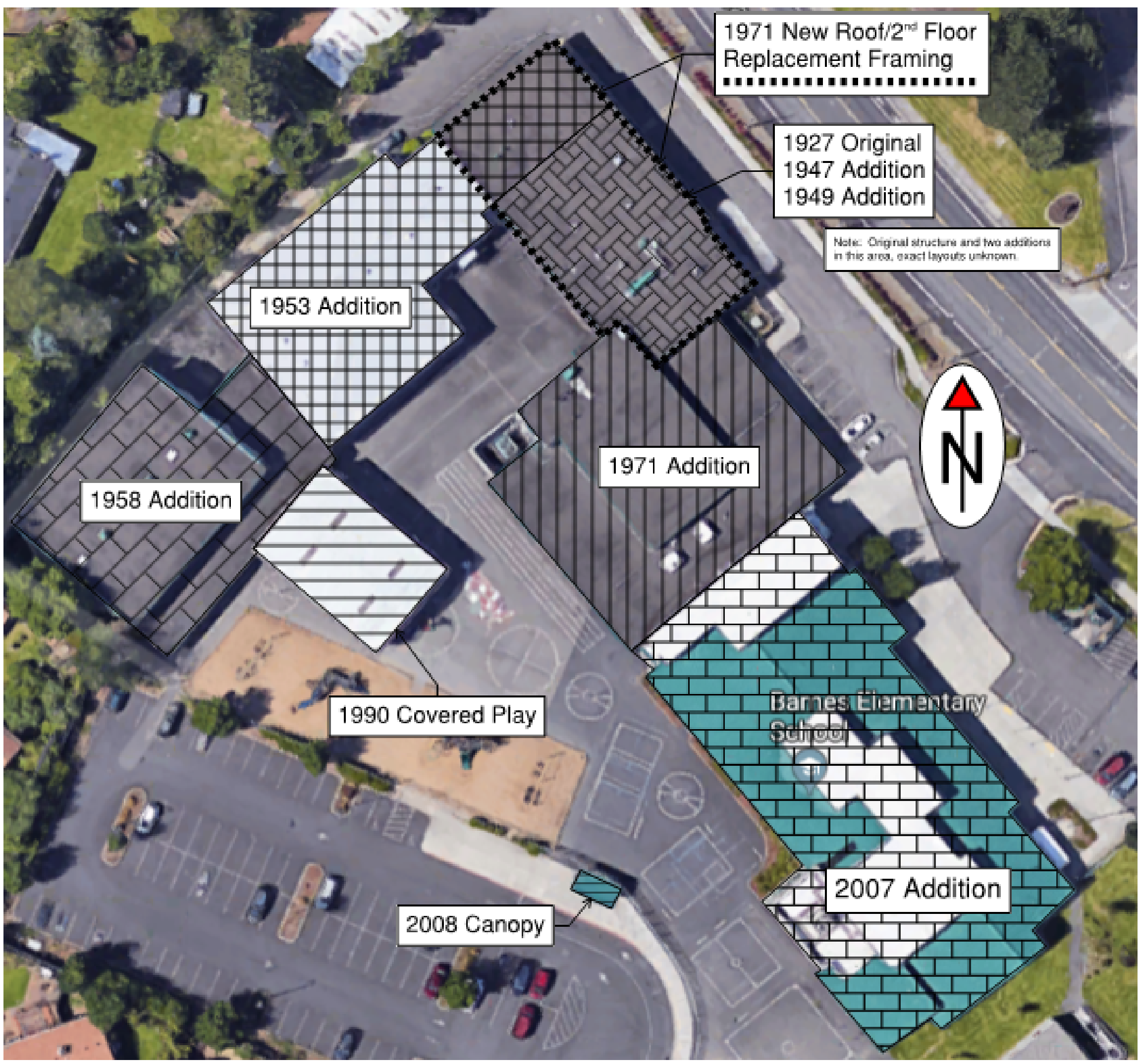
02: Barnes Elementary School

<u>Building Summary and Building Year Plan</u>

The Barnes Elementary School was constructed in 1927 with additions in 1947, 1949, 1953, 1958, 1971, and 2007; with an exterior covered play area in 1990 and canopy in 2008. The 1971 addition drawings also indicate that the roof framing and potentially top story was replaced (as indicated in the plan below) over the 1927, 1947, 1949, and part of 1953 areas.

Various lateral force-resisting systems exist throughout the different additions, including wood framed shear walls (W2), reinforced masonry walls (RM1), and steel moment frames at the covered play area. The roof diaphragms construction also varies including: plywood, wood decking, and metal decking.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original two-story structure was built in 1927 with two small additions added in 1947 and 1949, respectively. There are no drawings available for the 1927 initial construction. The 1947 and 1949 construction phases do not have clear existing drawings and there is no clear separation of building years through visual observations. Each addition was constructed with wood framed walls at the exterior with stucco siding. The first floor and roof are framed with wood construction including glulam beams with diagonal sheathing. Exterior concrete foundation walls are used around the lower level as bearing and retaining walls. A concrete slab-on-grade is used at the lower floor with shallow concrete foundations. The roof diaphragm was originally wood decking with a plywood upgrade, and the roof framing replacement occurred during in the 1971 addition.

The 1953 addition is constructed similarly to the previous phases as it uses the same two-level construction of exterior wood wall framing with stucco siding, diagonal wood decking at the first floor level, and glulam beams. Steel columns are used at the interior to support the first floor framing. Shallow concrete foundations and slab-on-grade are again used and doweled into the existing foundations. The roof diaphragm consists of wood decking with glulam beams and built-up roofing.

The 1958 addition added a gymnasium to the campus on the far west side of the 1953 addition as well as a covered walkway/play area. The construction for this addition consists of exterior reinforced masonry and concrete walls which act as both the gravity and lateral force-resisting system. The roof framing is glulam beams bearing on the concrete walls with wood decking acting as the roof diaphragm. The covered areas are supported with steel columns with glulam beams and wood decking at the roof. The columns are cantilevered from the concrete foundations with asphalt paving bracing the foundations laterally.

The single-story 1971 addition added new classrooms and a multipurpose area to the southeast side of the original building, as well as adding a new roof to both the original structure and the north side of the 1953 addition. The construction for this addition primarily consisted of wood wall framing at the exterior and interior. The exterior walls have stucco siding, while the interior walls have plywood sheathing and act as shear walls for the addition. The new roof at both the addition and original building uses glulam beams, TJI joists, and a plywood diaphragm.

The 1990 standalone covered play area was built on the east side of the 1958 addition. It consists of steel moment frames in both directions which acts as the lateral and gravity system. Metal decking is used at the roof acting as the diaphragm.

The 2007 addition added multiple new classrooms and a library space to the southeast of the 1971 addition. This addition uses wood framing across the entire area including wood framed walls with plywood sheathing, glulam roof beams, TJI roof joists, and plywood decking. Shallow concrete foundations make up the foundation system and a reinforced concrete slab-on-grade is the floor. The lateral force-resisting system consists of wood framed shear walls with plywood sheathing tying into the plywood roof diaphragm and the concrete foundations.

In 2008 a small standalone steel-framed canopy was added to the west of the 2007 addition. The framing acts as the gravity and lateral force-resisting system with a steel moment frame in one direction and cantilevered column in the other.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior wood framed walls use stucco siding as lateral sheathing, which is not adequate.
- Vertical masonry reinforcement is spaced too far apart per checklist requirements.
- Miscellaneous CMU walls in early additions require bracing/anchorage.
- Concrete piers between windows in concrete basement walls are not adequately reinforced and need to be strengthened.
- Wood ledgers are in cross-grain bending at some roof connections.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Cross ties at roof diaphragm will likely need to be strengthened.
- Straight sheathed wood decking is being used at multiple additions and needs to be replaced or overlain with a plywood diaphragm.
- Diaphragm to wall connections require strengthening for both in-plane and out-of-plane loads.
- Additional shear walls are required to meet the performance criteria of current codes
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings laterally.
- 1958 cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture unknown but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Sprinklers do not have gaps to prevent seismic cut off.
- Ceilings and lights are not braced apart from vertical wiring.
- Fire suppression piping is not braced.
- Lights require lateral bracing.
- Original or nonannealed overhead high window glazing can be a hazard and is present around the majority of the campus.

03: Beaver Acres Elementary School

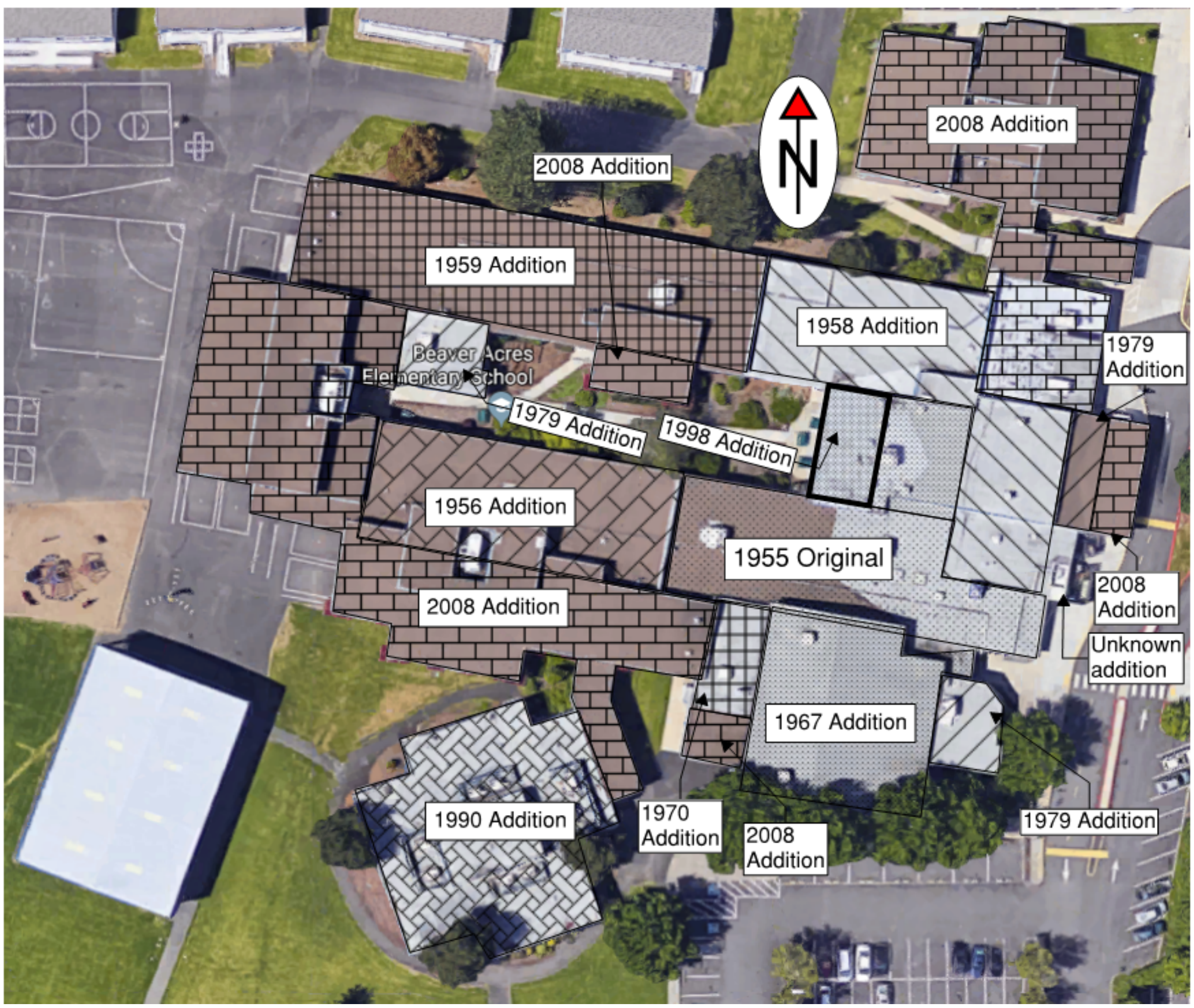
This school has been submitted for a grant through the State of Oregon's Seismic Rehabilitation Grant Program (SRGP). Application review is underway and if awarded, this school will undergo an ASCE 41-13 seismic upgrade.

Building Summary and Building Year Plan

The Beaver Acres Elementary School was constructed in 1955, with additions in 1956, 1958, 1959, 1967, 1970, 1979, 1990, 1998, and 2008.

Various lateral force-resisting systems exist throughout the different additions, including wood framed shear walls (W2), reinforced masonry walls (RM1) and concrete shear walls (C2). The roof diaphragms construction also varies including: diagonal sheathing, plywood and wood decking.

Building Risk Category III (SRGP application based on RC IV)
ASCE 41-13 Damage Control Performance Level (SRGP application based on Immediate Occupancy)



Building Description (separated by construction phases)

The original 1955 building is similar to the 1956, 1958, 1959, 1967, and 1970 additions. These sections have a concrete slab-on-grade with concrete shear walls, concrete spread footings, a concrete slab-on-grade, and a wood roof diaphragm. The 1955, 1956, 1958, 1959, and 1967 buildings are constructed with reinforced concrete shear walls that extend from the foundation to the diagonally sheathed roof. In the classrooms of the main building the north wall is composed of glass windows and steel supports, and the south wall includes an exterior concrete shear wall. There is a roof overhang past the south wall that served as a covered play area. This overhang was later enclosed during the 1970 additions with reinforced CMU walls and window storefronts. In addition to filling in the covered play area, the 1970 addition also included a locker room that is connected to the original 1967 gymnasium. The locker room is constructed of concrete shear walls, partial height internal CMU partitions, and a concrete slab-on-grade. The roof diaphragm is made up of diagonal sheathing.

The 1979 addition added two new classrooms and added on to the cafeteria. This addition is constructed of reinforced CMU walls, wood roof diaphragm, a concrete slab-on-grade, and concrete spread footings.

The first building wing to the south of the main building was constructed in 1990. This addition has a crawl space under the first floor, wood shear walls along the exterior of the building, and plywood roof diaphragm. The plywood first floor diaphragm is raised above grade supported by wood posts on concrete spread footings. The building has a roof pop-up in the middle of the building. The lateral force-resisting system consists of wood shear walls around the exterior of the building.

The library was expanded in 1998. This addition included a new concrete slab-on-grade, wood shear walls, and a plywood roof diaphragm supported by glulam beams. The west face of this addition is mostly glass storefront, but also has wood columns which support the glulam beams.

In 2008 there were major additions to the main building as well as an addition of a new classroom wing to the north of the main building. The main building additions added several new classrooms. All of the new additions from the 2008 construction consist of a concrete slab-on-grade, wood shear walls, and plywood roof diaphragms. The 2008 classroom wing is constructed with a plywood diaphragm, wood shear walls, and concrete footings. This addition is separated from the main building with a seismic joint.

Seismic Assessment

A full ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, Tier 1 evaluation was performed during the preparation for the seismic grant application. This report can be found on file with the Beaverton School District. A full list of deficiencies, seismic strengthening scheme and cost estimate is included in this report.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted. A full detailed list of deficiencies with photos can be found in the comprehensive full ASCE 41-13 report on file with the district.

- The class room halls in the main building do not have shear walls in both principal directions.
- The connections to the concrete and CMU shear walls are nonexistent for out-of-plane forces.
- Diaphragm to shear wall connection is insufficient for transfer of forces.
- The stirrups in coupling beams over means of egress are not spaced at or less than d/2. The coupling beams above the classroom entrances are part of a very long wall with little overturning and are deemed acceptable.
- Diaphragms have expansion joints and some roof locations have split level diaphragms.
- There are no continuous cross ties between the diaphragm chords.
- The current diaphragms for the main building consist of diagonal sheathing and spans more than 30 ft.
- For the 1990 classroom wing the unblocked diaphragm has a horizontal span of more than 40 feet.
- There is currently not a positive connection of the wood posts to the foundation in the 1990 addition.
- The concrete shear walls in the gymnasium are inadequate for out-of-plane loading.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- The fire suppression piping is not anchored or braced.
- Fire suppression piping does not have flexible couplings.
- Penetrations through panelized ceilings for fire suppression devices does not provide clearances in accordance with NFPA-13.
- Hazardous material is not equipped with restraints or snubbers.
- There is unreinforced masonry in the locker rooms.
- Free edges of integrated suspended ceilings do not have clearances from the enclosing wall or partition of at least ¾ inches.
- Free edges of integrated suspended ceilings are not supported by closure angles or channels not less than 2 inches wide.
- The seismic joints do not go through the nonstructural framing.
- Light fixtures are not independently supported in the drop ceilings.
- There is tall and narrow equipment that is not anchored or braced.
- Piping crossing seismic joints does not have couplings or other details to accommodate the relative seismic displacements.
- Duct work is not braced in some locations.

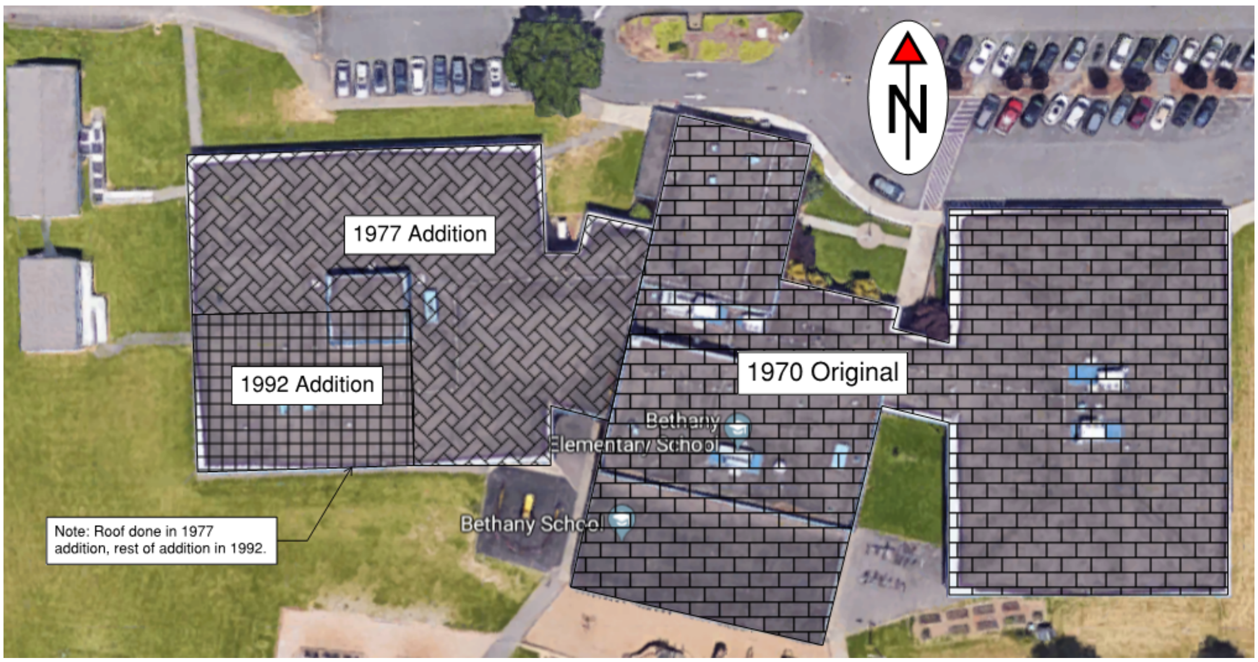
04: Bethany Elementary School

Building Summary and Building Year Plan

The Bethany Elementary School was constructed in 1970, with additions in 1977 and 1992.

The original single-story building is an exterior reinforced masonry wall structure (RM1) with tongue and groove decking and plywood sheathing. The two additions added new exterior reinforced masonry walls and interior wood shear walls (W2) with plywood roof sheathing.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1970 building construction consists of two wings with classrooms, a gymnasium, a kitchen/cafeteria area, and bathrooms. Structural elements include reinforced masonry bearing walls with steel tube columns to support the wood framing at the roof. The lateral force-resisting system consists of exterior reinforced masonry shear walls. The roof diaphragm is made up of 2 inch tongue & groove decking with plywood sheathing.

The 1977 addition includes new classroom areas, storage, and new bathrooms to the west of the original. Construction is similar to the original 1970 building with exterior masonry bearing walls, interior wood framing, tube steel columns, and a plywood sheathed roof. The foundation system consists of reinforced concrete shallow footings which appear to tie into the floor diaphragm and reinforced masonry shear walls. During this addition, a covered play area was added that made up the roof of the future 1992 addition. No seismic joints are present in the structure at this addition.

The 1992 addition consists of a direct expansion of the previous addition with new classrooms being added underneath the 1977 covered play area. The structure of this addition consists of exterior masonry walls, interior wood stud walls, and tube steel columns supporting the existing wood roof framing. Foundations include reinforced concrete pad and strip footings, and the floor system is a slab-on-grade that does not tie into the foundations directly. No seismic joints are present in the structure at this addition.

<u>Seismic Assessment</u>

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

<u>Summary of Seismic Structural Deficiencies</u>

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete foundation walls are not adequately anchored to foundations at original construction and additions.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Masonry walls lack sufficient anchorage to all diaphragm elements (both in-plane and out-of-plane).
- Panel decking over gym acts as straight sheathing, needs to be strengthened.
- Cross ties at roof diaphragm will likely need to be strengthened.
- Cross-grain bending in wood ledgers common at many roof diaphragm connections.
- Reinforcing in masonry shear walls does not meet minimum spacing requirements in both the main building and addition.
- Gymnasium walls lack out-of-plane connection at top of wall.
- Interior wood stud walls in both directions will require hold-downs, structural sheathing, and improved connections to the roof diaphragm in main building.
- Additional shear walls are likely required to meet the performance criteria in the addition.
- Small canopies do not tie back into lateral force-resisting system.

- Ties between foundation elements at the play shelter do not exist. Asphalt paving possibly restrains the footings.
- Cantilevered columns at the covered play area acting as a lateral force-resisting system is not sufficient to provide adequate support.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture unknown but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

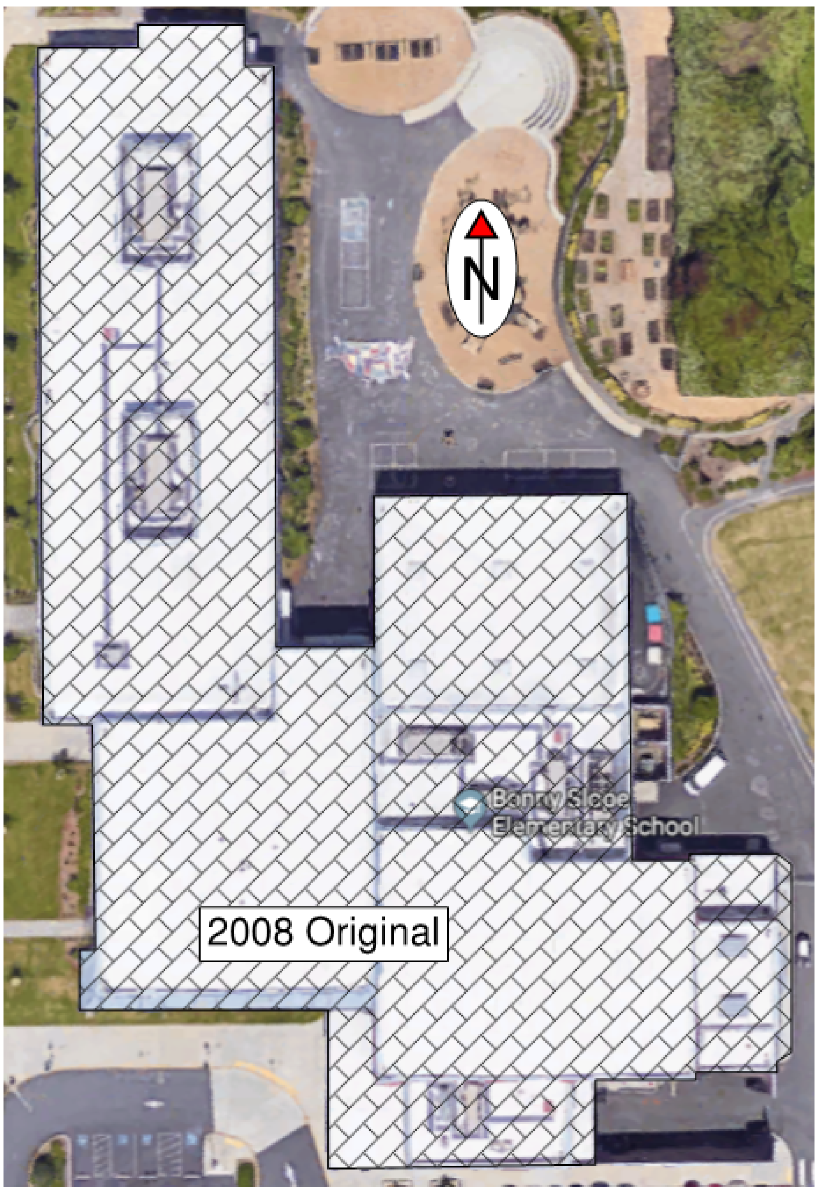
- Lights require independent support in the 1977 and 1992 additions.
- Drop ceilings require bracing across entire structure.
- Tall kitchen equipment requires anchorage in case of seismic event to prevent overturning.
- No seismic joints between additions.
- Equipment in mechanical penthouse do not have hold-downs.

05: Bonny Slope Elementary School

Building Summary and Building Year Plan

The Bonny Slope Elementary School was built in 2008. The lateral force-resisting system of this two-story structure is ordinary braced frames (S2). The roof diaphragm consists of steel decking while the floor diaphragm uses a steel composite deck with concrete topping. Both the roof and floor diaphragms are connected to the lateral force-resisting elements with in-plane and out-of-plane connections.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The 2008 school consists of classrooms, an administration area, gymnasium, cafeteria, and outdoor covered play area. The gravity system was made up of steel framing throughout the whole structure. The exterior also has a brick veneer finish which is tied back to steel support and metal stud walls. Foundations consist of reinforced concrete strip footings at the exterior walls and column footings at all interior and exterior columns. The ground floor system consisted of a reinforced concrete slab-on-grade with positive connections to the foundations. The lateral force-resisting system consists of braced frames in both primary directions tying into the roof and second floor diaphragm which were built with metal deck and concrete on metal deck, respectively. Steel canopies/sunshades are present on the exterior of the building, these were designed for the same lateral loads as the main structure.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- The original building structure was designed with a seismic importance factor of 1.25, which is roughly equivalent to the Damage Control Performance Level.
- Since this building was constructed, braced frame detailing requirements have changed and now require cover plates at the brace to gusset plate connections. These braces do not have these plates and require strengthening to meet current performance requirements.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture unknown but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

06: Cedar Mill Elementary School

This school has been prepared to be submitted for a grant through the State of Oregon's Seismic Rehabilitation Grant Program (SRGP). A full Tier 1 evaluation and report have been completed for Cedar Mill Elementary School.

<u>Building Summary and Building Year Plan</u>

The Cedar Mill School was built in 1950, with additions in 1953, 1955, 1959, 1971, and 1997. A partial seismic upgrade was completed in 1997.

The lateral force-resisting system of this two-story structure is comprised of wood shear walls (W2) and concrete shear walls (C2). The roof diaphragm consists of diagonal sheathing in the 1950, 1953, and 1955 additions and plywood decking in the 1959, 1971, and 1997 additions. The roof and floor diaphragms are not connected to the shear walls for both in-plane and out-of-plane for the 1950 through the 1959 additions.

Building Risk Category III (SRGP application based on RC IV)
ASCE 41-13 Damage Control Performance Level (SRGP application based on Immediate Occupancy)

Building Description (separated by construction phases)

The 1950 gymnasium building was an addition to the now demolished original structure. The gymnasium was built with reinforced concrete slab-on-grade and reinforced concrete continuous footings which support the wood shear walls. Diagonal roof sheathing is supported by wood purlins which span between glulam bowstring trusses. There was a lateral roof upgrade in 1997 which provided connections from the roof diaphragm to the wood shear walls for in-plane lateral forces.

The addition in 1953 included three new classrooms. The structure consists of diagonal wood sheathing for the diaphragm supported by 2x10 wood framing. The lateral force-resisting system is comprised of wood shear walls along the perimeter of the addition. The shear walls are supported by reinforced concrete continuous footings and tied together with a reinforced concrete slab-on-grade.

The 1955 addition added four new classrooms and new bathrooms. The construction is similar to the 1953 addition with diagonally sheathed diaphragms, wood shear walls, and reinforced concrete footings. The lateral force-resisting system utilizes the wood shear walls along the perimeter of the building. There is a crawl space under the west side of the addition. There is reinforced concrete stem walls that support the wood shear walls above and unreinforced CMU blocks that support the floor framing.

The 1959 addition is different than the original 1950 gym and the previous building additions as it is a two-store addition. The addition added classrooms to the first floor and a cafeteria on the second floor. The foundation of the structure consists of reinforced continuous concrete footings and a reinforced concrete slab-on-grade. The first floor of the building has concrete shear walls that act as the lateral force-resisting system and the second floor has wood shear walls. The wood shear wall ties into the top of the concrete shear wall at the second floor diaphragm. Steel columns are used to support the glulam beams and the combination of wood plywood and diagonal sheathing that make up the second floor diaphragm. The roof diaphragm is constructed of diagonal sheathing supported by 2x roof joists. The 1997 seismic roof upgrade added connections to transfer the in-plane forces of the roof to the wood shear wall on the north side of the addition.

The 1971 addition added a covered play area on the first floor and a library on the second floor. The foundation consists of reinforced concrete continuous footings, spread footings, and reinforced concrete slab-on-grade. The second floor is supported by precast reinforced concrete double T girders that rest on concrete shear walls and reinforced concrete columns. There are reinforced CMU partition walls located in the play area which are unbraced. The roof diaphragm is made up of ¾ inch blocked plywood and is supported with open web trusses that span to the wood shear walls.

The 1997 addition added a small classroom off of the 1955 addition. The foundation consists of reinforced concrete continuous footings that support a concrete stem wall which encloses the crawl space under the first floor. The first floor is supported with TJI wood joists and ¾ inch plywood decking. The roof framing is similar to the floor framing as it is also constructed of $^{5}/_{8}$ inch plywood sheathing and TJI joists.

Seismic Assessment

A full ASCE 41-17, *Seismic Evaluation and Retrofit of Existing Buildings*, Tier 1 evaluation was performed during the preparation for the seismic grant application. This report can be found on file with the Beaverton School District. A full list of deficiencies, seismic strengthening scheme and cost estimate is included in this report.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted. A full detailed list of deficiencies with photos can be found in the comprehensive full ASCE 41-17 report on file with the district.

- The out-of-plane anchorage and shear wall hold-downs are missing or non-compliant in various locations throughout the building.
- The foundations supporting the floor in the 1955 addition are not tied together.
- The north-south concrete walls at the first level of the 1959 addition are not sufficiently braced out-of-plane. Additionally, the CMU walls in the 1971 addition appear not to be braced, as observed on the site observation walk.
- The concrete columns supporting the second story of the 1971 addition do not have shear ties to develop the column in flexure.
- The existing sheathing on the existing wood stud walls is unclear from the existing drawings and could not be verified in the field. It is most likely a variety of straight sheeting, diagonal sheathing, and structural panel sheathing. If there is presence of straight sheathing, which is highly likely due to the years of construction, then the walls do not comply with this section.
- This building is predominantly a single-story building. However, there is no presence of hold-downs or anchors to resist overturning forces.
- It appears that the window openings in the 1950's gymnasium do not have any mechanism to transfer the shear to the walls below.
- It is unclear how the existing 1950 gymnasium posts are connected to the foundation from the existing drawings. It is assumed that there is not a positive connection.
- Diagonally sheathed and unblocked diaphragms with spans larger than 30 ft exist in the 1950, 1953, and 1955 additions.
- Wood sill bolt spacing is unknown for the 1950 addition through the 1959 addition and will likely need strengthening.
- The reentrant corners are not reinforced.
- During the site visit, some cracking was observed at the connections in the bowstring truss in the 1950 addition. Bowstring trusses with single bolted connections are prone to failures due to cracking of the wood members at the location of the bolts. These failures can occur without warning signs.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Fire suppression piping is likely un-braced.
- Flexible couplings are not part of the fire suppression piping.

- Fire suppression sprinklers in drop ceilings do not have the proper clearance.
- Hazardous piping is not braced.
- The edge of drop ceilings is not supported in the 1971 and 1997 additions.
- There are no safety clips in the light fixture lens covers throughout the building.
- The chimney in the boiler room is not braced to the structure.
- There are tall and narrow contents that are not braced throughout the building.
- There is fall prone content throughout the building.
- Suspended light fixtures in the classrooms are free to rotate and could cause damage during an earthquake.
- It was observed that fluid and gas piping was not properly braced.
- Duct work in the gymnasium attic is not braced.

07: Chehalem Elementary School

<u>Building Summary and Building Year Plan</u>

The Chehalem Elementary School was built in 1970, with additions in 1971 and 1987, a 2001 roofing upgrade, and a 2004 remodel.

The original building is a single-story reinforced masonry (RM1) structure with plywood sheathing and wood decking at the roof level. The 1971 addition added additional exterior reinforced masonry walls. The 1987 addition added a standalone building constructed of exterior wood shear walls (W2) and a plywood roof and floor diaphragm. A 2004 addition added classroom space below the existing roof.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The original 1970 building construction consists of two wings with classrooms, a gymnasium, a kitchen/cafeteria area, and bathrooms. Structural elements included masonry bearing walls with steel tube columns to support the wood framed gravity framing at the roof. The floor and foundation system supporting these elements is a reinforced concrete slab-on-grade and shallow foundations. The lateral force-resisting system is comprised of reinforced giant brick masonry shear walls at the exterior and some interior locations. The roof diaphragm of the original building consists of 2x decking with a potential plywood diaphragm, much of the original roof diaphragm was strengthened with new plywood decking in the 2001 roofing upgrade.

The 1971 addition includes new classroom areas, storage, new bathrooms, and a covered play area. The construction of this addition is similar to the original building with exterior masonry bearing walls, interior wood framing, tube steel columns, and a plywood sheathed roof. Steel wide flange beams are used as girders to support glulam beams at the roof level. The lateral force resisting system consists of exterior masonry walls on the north, south, and east sides. The roof diaphragm consists of plywood sheathing.

The 1987 addition consists of new classrooms, bathrooms, and a covered walkway to the north side of the campus. The structure of this addition consists of a reinforced concrete foundation system with steel tube columns supporting wood roof framing at the roof level. The floor system consists of an elevated wood system with plywood diaphragm supported by relatively small concrete posts. Exterior walls are wood framed stud walls with stucco covering. The roof diaphragm is a flexible plywood decking with built-up roofing.

The 2001 roofing upgrade consisted of adding new plywood diaphragms to all areas of the existing structure except over the Gymnasium and Office areas. It is not clear in the drawings the exact extents of the new plywood diaphragm. This new diaphragm is connected directly to the exterior reinforced masonry walls which act as the lateral force-resisting system.

The 2004 remodel added new wood framed shear walls at the north wing, in the north-south direction only. These shear walls were connected to the foundations and to the existing plywood diaphragm at the roof. This remodel included some modifications to the foundation at the kitchen area as well as the north wing where the shear walls were installed.

Note: This construction of this school is very similar to #31: Terra Linda.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete foundation walls are not adequately anchored to foundations at original construction and 1971 addition.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Masonry walls lack sufficient anchorage to all diaphragm elements (some strengthening was completed in 2001).
- Roof diaphragm at the Gymnasium and Office may need to be strengthened with a new plywood diaphragm. Connections to shear walls also need to be strengthened.
- Interior and exterior wood stud walls in both directions will require hold-downs, structural sheathing, and improved connection to roof diaphragm (in original 1970 and 1971 addition).
- Wood posts do not have a positive connection to the foundations or the built-up wood girders in the 1987 addition.
- 1971 addition – new plywood shear walls are needed in both directions in the interior to reduce diaphragm span.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Lights require independent support in the 1970 addition.
- Drop ceilings require bracing across the 1970 addition.
- Tall kitchen equipment require anchorage in case of seismic event to prevent overturning.
- No seismic joints between additions.

08: Cooper Mountain Elementary School

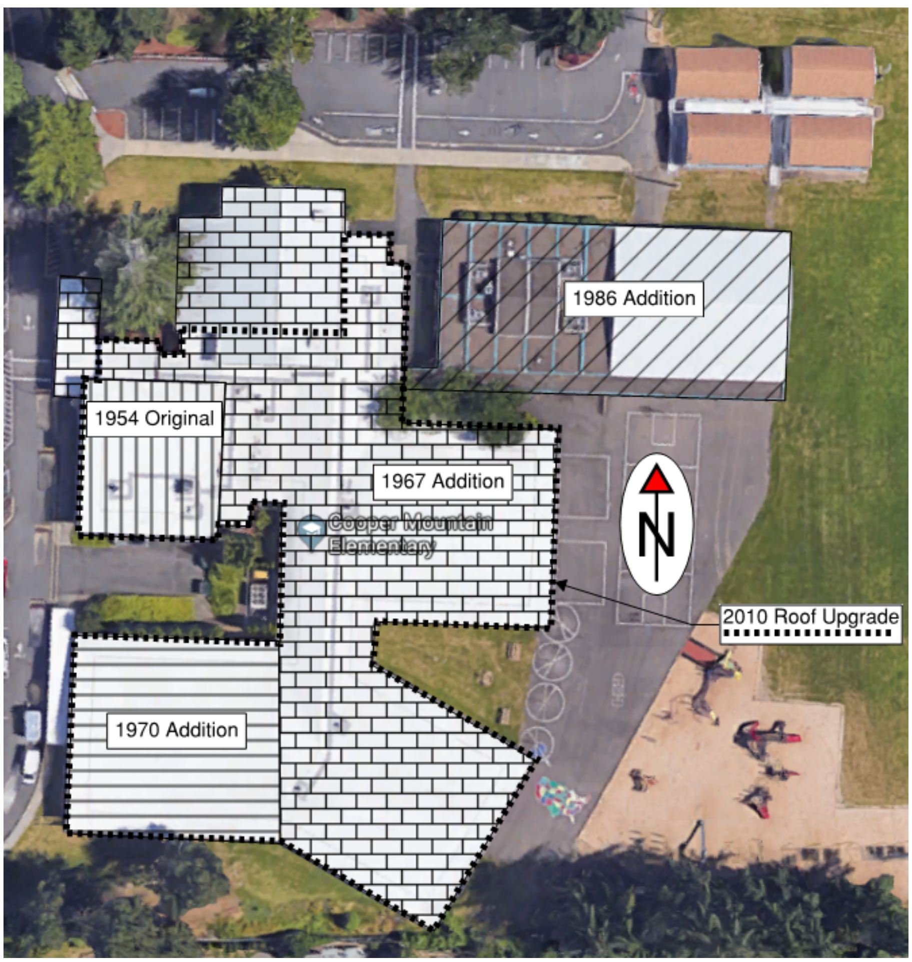
This school has been submitted for a grant through the State of Oregon's Seismic Rehabilitation Grant Program (SRGP). Application review is underway and if awarded, this school will undergo an ASCE 41-13 seismic upgrade.

Building Summary and Building Year Plan

The Cooper Mountain Elementary School was built in 1954, with additions in 1967, 1970, and 1986. A roof level seismic upgrade was performed in 2010. There were earlier areas of the building that have since been demolished.

The primary lateral force-resisting system for this structure is exterior concrete walls (C2) with a small number of existing wood framed shear walls. The 1986 addition is wood framed for the classroom portion and steel cantilevered columns at the covered play area. The roof diaphragm is a flexible wood diaphragm, with plywood over the majority (except at the gymnasium).

Building Risk Category III (SRGP application based on RC IV)
ASCE 41-13 Damage Control Performance Level (SRGP application based on Immediate Occupancy)



ELEMENTARY SCHOOLS
MIDDLE SCHOOLS
HIGH SCHOOLS
OPTION SCHOOLS
SUPPORT FACILITIES

Building Description (separated by construction phases)

The 1967 and 1970 additions are single-story additions which comprise the majority of the building area. These portions of the building have a wood framed roof that consists mostly of glulam beams that support wood joists and plywood sheathing. Along the corridor to the south classroom wing the roof is framed out of gable trusses and plywood sheathing. The wood roof framing is supported by exterior reinforced concrete walls and interior pipe columns. The concrete walls and pipe columns are supported by conventional strip and spread footings, respectively, with a slab-on-grade. Out-of-plane connection strengthening was added to a portion of these additions in 2010 along with collector strapping. Out-of-plane connection strengthening was added to only one wall around the gymnasium in 2010.

The 1954 cafeteria is the oldest remaining part of the school. It consists of a double height multipurpose room that is used as the cafeteria. To the south there is a two-level volume that is used as a kitchen on the first level and a music room on the second level. This area of the school is constructed mainly out of wood framing, although existing drawings are unclear as to how exactly this area is framed. The 1967 and 2010 remodel drawings indicate that this area has wood walls with a shiplap roof. Plywood sheathing was added in 2010. This area has a conventional slab-on-grade with a shallow foundation.

The 1986 addition drawings are in poor condition and it is difficult to decipher how some portions of this addition are framed. The classroom portion of the building has a plywood roof that is supported by wood joists and glulam beams. The beams are supported by interior wood posts and exterior wood bearing walls with embedded wood posts. The covered play area has a wood framed roof that consists of plywood sheathing, wood joists, and glulam beams. The beams are supported by steel posts that cantilever upward from concrete pier foundations.

Seismic Assessment

A full ASCE 41-17, *Seismic Evaluation and Retrofit of Existing Buildings*, Tier 1 evaluation was performed during the preparation for the seismic grant application. This report can be found on file with the Beaverton School District. A full list of deficiencies, seismic strengthening scheme and cost estimate is included in this report.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted. A full detailed list of deficiencies with photos can be found in the comprehensive full ASCE 41-17 report on file with the district.

- Lack of shear transfer connection between the walls and the diaphragm.
- There is a lack of shear walls in certain areas of the building. New shear walls are included in the strengthening scheme along with hold-down anchors where needed.
- Gymnasium walls are not adequate for out-of-plane forces and require strengthening.

- Wood posts in the 1987 addition are not attached to the foundations or the wood floor framing. This needs to be repaired along with bracing the foundations to tie them to the structure.
- The diaphragm in the main building needs to be blocked in the classroom wings and strengthened over the gym. Cross ties need to be added.
- The connection of the concrete walls around the gymnasium to the diaphragm needs to be strengthened.
- The diaphragm in the 1987 addition needs to be strengthened around the roof pop-up. Cross ties need to be added.
- 1987 CMU wall requires a strengthened connection to the diaphragm.
- 1987 covered play addition has tall slender columns that need to be strengthened.

<u>Summary of Seismic Nonstructural Deficiencies</u> (included in cost per square foot above)

- Fire suppression piping is not braced.
- Flexible couplings needed.
- Sprinkler heads do not have clearance from seismic breakoff.
- Hazardous material distribution.
- A few light partitions need to be braced.
- Ceilings are not braced laterally.
- URM chimney needs to be anchored to the roof and floor diaphragms.
- Lights are not independently supported from the ceiling system.

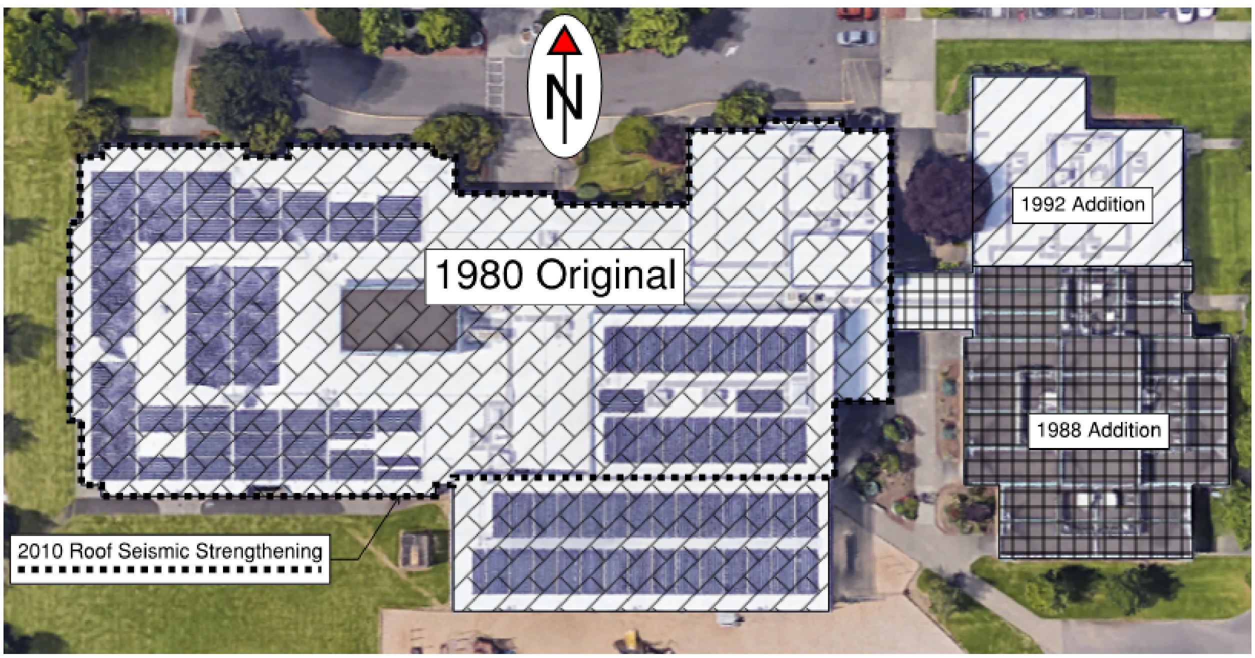
09: Elmonica Elementary School

Building Summary and Building Year Plan

The Elmonica Elementary School was built in 1980, with additions in 1988 and 1992, and a 2010 seismic roofing upgrade.

The original building consists of a single-story precast tilt-up (PC1) lateral force-resisting system with plywood sheathing, metal decking over gym, and wood decking over the covered play area at the roof. The 1988 and 1992 additions added a wood framed (W2) structure with a plywood roof diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original structure included a classroom wing, cafeteria, bathrooms, administration areas, and a gymnasium. The building consists of exterior precast concrete tilt-up shear walls with a plywood diaphragm at the majority of the roof. At the gymnasium there is an acoustical metal deck diaphragm, and at the covered play area there is 3x wood decking which acts as straight sheathing. The floor system is a reinforced concrete slab-on-grade. The gravity system is comprised of the exterior precast tilt-up walls as well as interior steel tube and wood post columns. The roof framing consists of wood beams except at the gymnasium where the roof is framed with steel joists.

The first addition in 1988 added a classroom wing. This structure has a lateral force-resisting system consisting of wood framed shear walls at the exterior. The gravity system incudes these shear walls as well as wood posts. The foundation system is a reinforced concrete shallow foundation system. The floor for this new wing is an elevated wood floor system with plywood sheathing supported on wood posts and perimeter concrete stem walls. The roof is also framed with wood beams and joists with plywood sheathing covering the entire structure. There is no seismic joint between the 1988 addition and the 1980 original building.

The 1992 addition added four more classrooms directly north of the previous addition and is constructed in a very similar manner. There is no seismic joint between these two additions. Floor framing consist of wood decking supported by relatively small wood posts that do not have a positive connection to their concrete footings. The roof diaphragm consists of plywood decking.

The 2010 roof seismic strengthening project added new plywood sheathing to areas of the 1980 addition (except the covered play area) that were either missing plywood sheathing or had deficient sheathing. The connections of the diaphragm were also evaluated and upgraded to provide proper connection to the lateral force-resisting system. The covered play area still consists of straight sheathed wood decking.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Precast concrete walls at gymnasium area do not meet the thickness-to-height ratio. (1/53 actual < 1/40 minimum).
- Potential connection strengthening needed from the gym walls to roof diaphragm.
- Main building plywood diaphragms are not all blocked and exceed the 40 ft span limit. These diaphragms may prove to be adequate with more analysis.
- No positive connections from wood posts to foundations at both 1988 and 1992 additions.

- Roof diaphragm at covered play area is wood decking acting as straight sheathing.
- Cantilevered columns at covered play are not sufficient to provide adequate support.
- Ties between foundation elements at play shelter does not exist. Asphalt paving possibly restrains footings.
- Wood roof diaphragm at 1992 addition may need strengthening.
- Additional interior shear walls required to create shorter spans for diaphragm for both the 1988 and 1992 additions.
- Roof pop-ups at additions require additional chords and collector members.
- Pop-up roof at 1988 addition has glazing full length of east and west sides, is a potential falling hazard and creates a diaphragm discontinuity.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Fire suppression piping is not braced.
- Sprinkler heads do not have clearance from seismic breakoff.
- Ceilings are not braced laterally apart from vertical wiring.
- Lights are not independently supported from the ceiling system.
- No seismic joints between additions.

10: Errol Hassell Elementary School

Building Summary and Building Year Plan

The Errol Hassell Elementary School was built in 1979, with an addition in 1985 and a 2009 roofing upgrade.

The original building is a single-story precast tilt-up (PC1) with plywood sheathing, metal decking, and wood decking at the roof level. The 1985 addition is a wood framed (W2) structure with a plywood roof diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The 1979 original structure includes a classroom wing, cafeteria, bathrooms, administration area, and a gymnasium. The gravity system includes the exterior precast tilt-up walls as well as interior steel tube and wood post columns. The roof framing consists of wood beams, except at the gymnasium where the roof is framed with steel joists. The roof diaphragm is made up of three different materials. The majority of the building has a plywood roof diaphragm, while the gymnasium has an acoustical metal deck diaphragm, and the covered play area has a 3 inch straight board decking diaphragm. The lateral force-resisting system consists of the exterior precast walls.

The 1985 addition added a new classroom wing to the northeast. This structure has a lateral force-resisting system consisting of wood framed shear walls at the exterior. The gravity system incudes these wood walls as well as steel tube columns and wood posts around the interior of the addition. The foundation system is a reinforced concrete shallow foundation system. The floor for this new wing is an elevated wood framed floor system with plywood decking that ties into the foundations and wood walls. The roof is also framed with wood beams and joists with plywood decking across the entire addition.

The roof upgrade project in 2009 verified the existing roof diaphragm of the 1979 addition. If decking was either missing or structurally deficient, it was replaced with new plywood decking. The diaphragm to wall connections were also strengthened for both in-plane and out-of-plane forces.

Note: This school is very similar to #13: Greenway Elementary.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Precast concrete walls at gymnasium area do not meet the thickness-to-height ratio requirement (1/53 actual < 1/40 minimum).
- No out-of-plane support at the gym roof on the north side. The lateral upgrade in 2009 did not add connections as shown in the drawings on either north or south side.
- Potential connection strengthening needed from the gym walls to roof diaphragm.
- Main building plywood diaphragms are not all blocked and exceed the 40 ft span limit. These diaphragms may prove to be adequate with more analysis.
- Additional shear walls are likely required to meet the performance criteria of current codes in the main building.
- Concrete tilt-up wall at 1979 penthouse does not extend to the high roof, but extends approximately 4 ft above the low roof creating a “hinge” for out-of-plane forces. This wall could possibly cantilever from the low roof but requires more evaluation.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Straight sheathing (wood decking) at play shelter.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- No positive connection from wood posts to foundations at 1985 addition.
- Wood plywood shear walls likely do not have shear capacity to provide sufficient support against lateral loads in 1985 addition.
- Anchor bolts in exterior walls at addition could not be located, assumed to be there and not visible per drawings.
- 1985 addition – roof pop-up creates discontinuous diaphragm. Chord detailing of addition is unclear in drawings. Collectors are also needed at the roof diaphragm.
- Geologic site hazards such as Liquefaction, Slope Failure, and Surface Fault Rupture are unknown but are likely not a deficiency for this site. The 1985 Addition has a steep hill to the north side.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Sprinklers do not have gaps to prevent seismic cut off.
- Ceilings and lights are not braced apart from vertical wiring.
- Partition walls in addition do not go up to ceiling, walls in original 1979 structure did.
- Fire suppression support is not braced.

11: Findley Elementary School

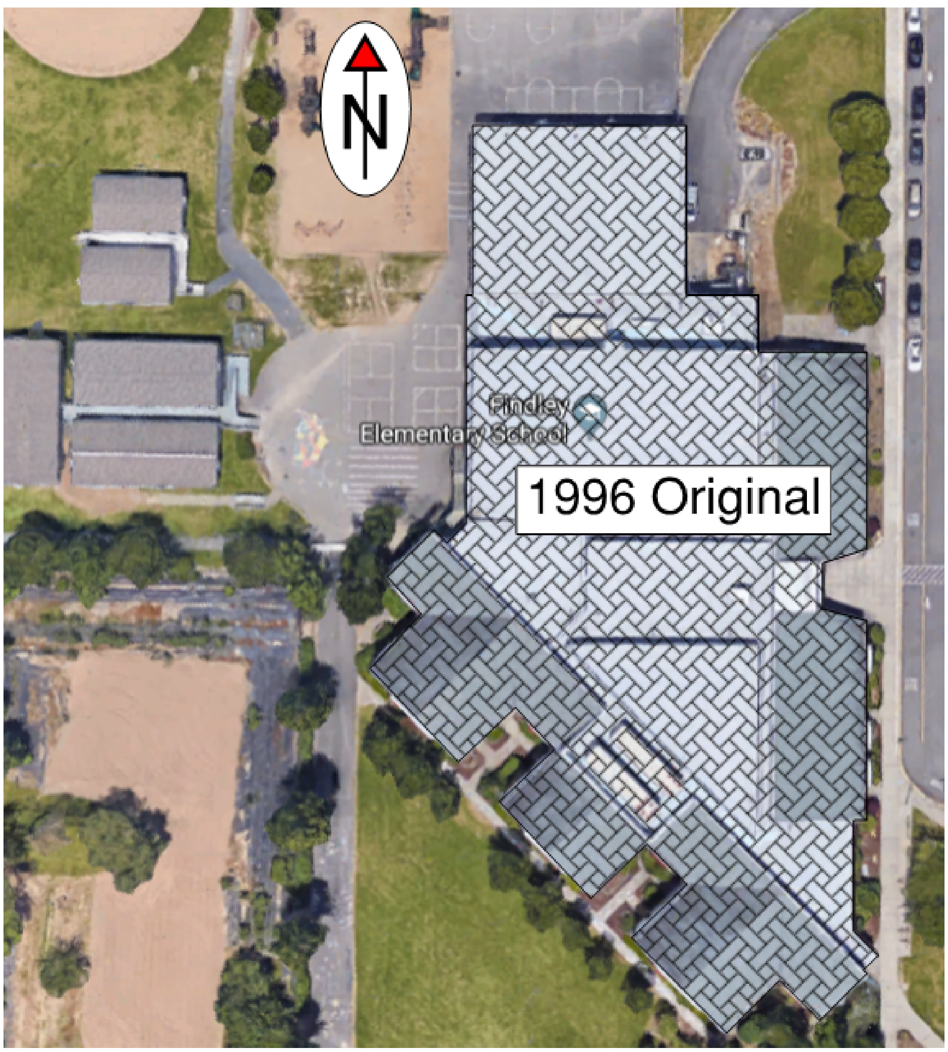
Building Summary and Building Year Plan

Findley Elementary school was constructed in 1996. The following schools are very similar in plan and in detailing:

- Findley Elementary School
- Nancy Ryles Elementary School
- Scholls Heights Elementary School

This two-story, primarily wood framed building (W2) has a flexible plywood roof, as well as second floor diaphragms. A rigid concrete diaphragm is used at a small portion over the commons area to support mechanical units.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases

The school is a two-story structure with classrooms, gymnasium, cafeteria, covered play area, and large central open library. The vertical gravity system is composed of steel tube and pipe columns holding up primarily glulam beams at the second floor, and roof level with some wood joists used as secondary support. The structure has a foundation system consisting of shallow reinforced concrete foundations and a reinforced concrete slab-on-grade floor which has direct connections to the foundations. Wood trusses and glulam beams are used to support the roof decking. A few large portions of roof framing at the southwest side are sloped while the remaining roof is flat. Plywood decking is used on the roof and at the second floor which act as the building diaphragm to move lateral loads into the wood framed shear walls acting as the primary lateral force-resisting system. There is also a large reinforced CMU masonry wall at the covered play exterior wall which provides lateral restraint in the east-west direction. The original seismic design loads are in accordance with UBC Zone 3.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Large triangular roof pop-up with continuous windows at central library area.
- Steel columns at pop-up area cantilevering up with likely inadequate weak way bending capacity.
- The roof diaphragm is discontinuous and has several pop-up areas including the roof at the library/commons.
- Roof diaphragm contains plywood but is not blocked in all locations. Further analysis is required to determine extent of seismic retrofitting required.
- Gypsum wallboard is use for a few shear walls in several locations in the crawl space.
- Roof chords are discontinuous at sloped roof pop-ups.

- Strapping is required around pop-ups to help provide accurate lateral support.
- There are no continuous collector elements to drag the covered play area roof loads into the main structure roof diaphragm for lateral loads perpendicular to the CMU wall.
- The reinforced masonry shear wall is anchored to the high covered play and gymnasium roof diaphragms with a wood ledger connection that may lack the required strength to support the wall for out-of-plane forces.
- The existing drawings show the vertical reinforcement in the masonry shear wall ending at the bottom of the covered play area beams and not extending to the top of the wall.
- Geologic site hazards such as Liquefaction, Slope Failure, and Surface Fault Rupture are unknown. Slope failure could be an issue at this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Tall kitchen equipment and shelving require anchorage in case of seismic event to prevent overturning.
- Fire suppression and other piping require lateral bracing.
- Large overhead glazing at library area may be hazardous.

12: Fir Grove Elementary

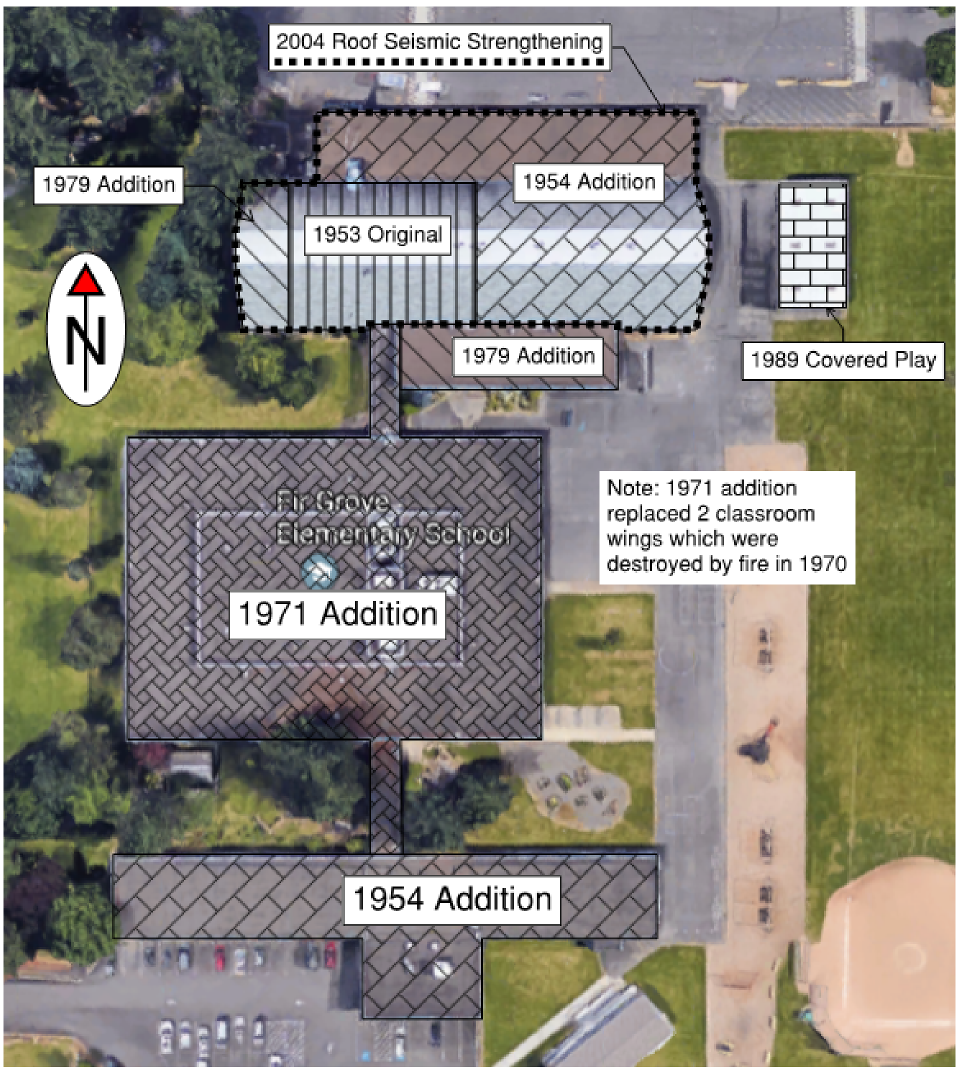
Building Summary and Building Year Plan

The Fir Grove Elementary School was built in 1953, with additions in 1954, 1971, and 1979, with a 2004 seismic roofing upgrade, and 1989 covered play area.

Note: Most of the original 1953 structure was destroyed in a 1970 fire.

The lateral force-resisting system for this structure consists of reinforced masonry walls (RM1) and wood framed shear walls (W2) with plywood and gypsum board sheathing. The roof sheathing consists of plywood sheathing and tongue and groove wood decking.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Description (separated by construction phases)

The original 1953 building consisted of three wings. Two for classrooms and a third cafeteria and kitchen area. The gravity system for the arched roof kitchen/cafeteria is exterior masonry walls and wood framed walls. There are also interior wood posts and wood bearing walls. The lateral force-resisting system is primarily comprised of exterior plywood framed shear walls. The shallow foundations consist of a reinforced concrete slab-on-grade system. The roof system is an arched glulam beam with tongue and groove decking.

The addition in 1954 added a new classroom wing and expanded the existing cafeteria wing to include a new gymnasium. The classroom wing consists of interior wood framed shear and bearing walls with plywood sheathing, as well as a few masonry walls in the opposite direction. At the exterior are wood framed walls with sheathing. However, these walls do not go all the way up to the roof as there is a line of windows at the top across the length of the addition. The opposite side of the classroom wing has an entire line of windows going all the way across with no lateral support. The new gymnasium has the same arched glulam beam support as the original. The new covered play area next to the gymnasium wing is supported by wood posts and glulam roof beams.

Note: A fire in 1970 destroyed the two classroom wings of the original 1953 building, with only the 1954 classroom wing and the cafeteria/gymnasium wings surviving.

The addition in 1971 consists of a large classroom area to replace what was destroyed in the fire. This addition is located in the middle of the two existing areas and there are enclosed walkways to both areas. The construction of this new wing matches the other areas with exterior masonry walls and interior wood stud walls with glulam roof framing. In addition, there are steel tube columns and wood joists being used for gravity support in this area. This addition uses plywood sheathing at the roof structure and is designed for seismic lateral force-resisting forces using the UBC Zone II requirements. The lateral force-resisting system consists of exterior reinforced masonry shear walls. There are a few small wood framed walls with gypsum board sheathing that are anchored down and can also act as shear walls.

The 1979 addition includes two new spaces at the existing cafeteria/gymnasium area, an extension to the cafeteria area along the west side and a new small classroom wing along the south side. The cafeteria extension matches the original arched glulam style. There is no masonry in this addition, all exterior walls are wood framed stud walls with some interior steel tube columns. The roof and exterior stud walls both have plywood sheathing acting as the diaphragm and lateral force-resisting system, respectively.

The 1989 standalone covered play area is a steel framed structure with a metal roof deck. The lateral force-resisting system for this structure is a series of moment frames that only go in one direction, with no support in the perpendicular.

The 2004 re-roofing added plywood sheathing to the roofs of the arched cafeteria/gymnasium wing, as well as the covered play area on the north side. In addition, some strengthened connections from the diaphragm at these areas were added to provide adequate force transfer to the supporting elements per the requirements of the 1997 UBC and 1998 OSSC.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Wood decking at the 1954 addition classrooms requires strengthening to act as an adequate diaphragm.
- 1954 addition only has one line of shear wall in the east-west direction.
- Cross ties at roof diaphragm will likely need to be strengthened.
- Wood ledgers are in cross-grain bending at some roof connections.
- Masonry reinforcement spacing is greater than maximum allowed.
- Interior and exterior wood stud walls in one direction will require hold-downs, structural sheathing, and connection to roof diaphragm.
- In-plane and out-of-plane connections to the brick walls are not adequate at the 1971 addition. It appears some in-plane strengthening was completed in 2004 but some areas were observed on-site to be deficient.
- CMU walls at the gymnasium/cafeteria and at the ends of the classroom wings need to be strengthened and anchored for in-plane and out-of-plane forces.
- Wood connections to the foundations may need strengthening at the older areas.
- Additional shear walls are likely required throughout to meet the performance criteria of current codes.
- 1989 standalone covered play area only has a defined lateral force-resisting system in one primary direction.
- Ties between foundation elements at 1954 play shelter do not exist. Asphalt paving possibly restrains footings.

- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Ceilings and lights are not braced apart from vertical wiring.
- Fire suppression and other piping is not braced.
- Original or nonannealed overhead glazing can be a hazard.

13: Greenway Elementary School

Building Summary and Building Year Plan

Greenway Elementary School was built in 1979, with an addition in 1987, and a 2009 roofing upgrade.

The original building consists of single-story precast tilt-up walls (PC1) with a roof diaphragm consisting of plywood sheathing, metal decking, and straight board wood decking. The 1987 addition is a wood framed (W2) structure with a plywood roof diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The original 1978 structure includes a classroom wing, cafeteria, bathrooms, administration areas, and a gymnasium. The gravity system uses exterior precast tilt-up walls, interior steel tube columns, and wood post columns. The roof framing was made up of wood beams everywhere except at the gymnasium, which was built using steel roof joists. The roof diaphragm is made up of three different materials. The majority of the building is plywood decking, the gymnasium roof uses acoustical metal deck, and the covered play area has 3" straight board wood decking.

The first addition in 1987 consists of a new classroom wing to the southeast. The lateral force-resisting system consists of wood framed shear walls at the exterior. The gravity system incudes these wood walls as well as steel tube columns and wood posts. The foundation system is made of a reinforced concrete shallow footings. The floor for this wing is an elevated wood framed system with plywood decking that ties into the foundations and exterior wood walls. The roof is framed with glulam beams and wood joists and plywood decking across the entire roof of this addition.

The roof upgrade project in 2009 added new plywood decking across the entire original 1979 roof. The connections between the diaphragm and wall were also strengthened for both in-plane and out-of-place forces.

Note: This school is very similar to #10 Errol Hassell Elementary.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Precast concrete walls at gymnasium area do not meet the thickness-to-height ratio requirement (1/53 actual < 1/40 minimum).
- No out-of-plane support at gym roof on north side, lateral upgrade in 2009 did not add connections as shown in the drawings on either the north or south side.
- Concrete tilt-up wall at 1979 penthouse does not extend to the high roof and extends approximately 4 ft above the low roof creating a "hinge" for out-of-plane forces. This wall could possibly cantilever from the low roof but requires more evaluation.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Straight sheathing (wood decking) at play shelter, requires a replacement and/or upgrade.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.

- No connection from wood posts and wood sills to foundations at addition. Tall crawl space acts as an additional story and requires bracing to strengthen.
- Wood plywood shear walls likely do not have shear capacity to provide sufficient support against lateral loads at the addition
- 1987 addition – roof pop-up creates discontinuous diaphragm. Chord detailing of addition is unclear in drawings. Collectors are also needed at the roof diaphragm.
- Anchor bolts in exterior walls at addition could not be located, assumed to be there and not visible per drawings.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture unknown but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Sprinklers do not have gaps to prevent seismic cut off.
- Ceilings and lights are not braced apart from vertical wiring.
- Partition walls in addition do not go up to ceiling, walls in original 1979 structure did.
- Fire suppression piping is not laterally braced.
- Some mechanical and kitchen equipment was not anchored down or braced laterally.

14: Hazeldale Elementary School

Building Summary and Building Year Plan

The Hazeldale Elementary school was constructed in 2018 and structurally designed by the DLR Group. The primary lateral force-resisting system for this structure consists of special steel concentrically braced frames and intermediate precast shear walls.

Building Risk Category IV
Roughly equivalent to ASCE 41-13 Immediate Occupancy Performance Level

Building Description (separated by construction phases)

This is a new elementary school building constructed in 2018 replacing the older building originally constructed before 1954. This new building includes new classrooms, cafeteria, gymnasium and covered play area. The structure consists of steel framing, precast concrete wall panels and reinforced masonry walls. This building was designed for seismic risk Category IV.

Seismic Assessment

Due to the recent year of construction, this is a "benchmark building" per ASCE 41-13 and was not evaluated during this assessment for structural deficiencies.

15: Hiteon Elementary School

Building Summary and Building Year Plan

The Hiteon Elementary School was built in 1974, with additions in 1977, 1986, 1989, and 2008, with a roofing upgrade in 2003.

The original building is a single-story brick reinforced masonry (RM1) building with a plywood roof diaphragm. The subsequent additions in 1977 and 1986 also contain reinforced masonry shear walls. The 2008 addition has wood framed shear walls (W2) with plywood sheathing. The 1989 standalone covered play area has steel moment frames for lateral support in one direction with no perpendicular support.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The original 1974 building has two separate wings, the first having classrooms and a library. The second wing includes a cafeteria, gymnasium, bathrooms, and administration areas. There is also a covered play area on the southern side of the second wing. Both wings were built with exterior reinforced masonry bearing walls and interior steel and wood columns. These elements are supported by reinforced concrete foundations and slab-on-grade floor system. The foundations are then anchored and connected into the lateral force-resisting system. The lateral force-resisting system uses the exterior masonry shear walls as well as some interior masonry at the second wing. The roof diaphragm is made up of plywood decking. The roof framing supporting the diaphragm are wood glulam beams and joists.

The 1977 addition added a new classroom wing on the west side of the existing building. This wing is constructed using exterior masonry walls with exterior wood framed shear walls on the south side since it was designed for a future expansion. At this area is a new covered play area with an asphalt pavement floor instead of the reinforced concrete at the rest of the structure. The lateral force-resisting system for this addition is the exterior reinforced masonry shear walls and south side wood shear wall. On the interior there are steel tube and wood columns to support the roof framing. The covered play area roof is also supported by steel tube columns.

The addition in 1986 infilled the 1977 addition's covered play area with new classrooms. The roof framing and diaphragm was kept from the previous addition and not replaced. The asphalt pavement was replaced with a reinforced concrete slab and new exterior masonry walls were added to act as the lateral force-resisting system for the new area. An interior wood shear wall was also added in this new addition in the north-south direction.

The 1989 addition is a standalone covered play area to the south side of the main structure. This structure has steel framing in the form of columns, beams and metal deck. There are no structural drawings for this shelter, with the only information coming from the architectural drawings and site observations.

The seismic roof upgrade in 2003 modified much of the roof diaphragm connections around the original structure and 1986 addition. Adding new connections to the masonry shear walls with Simpson connectors and new nailing to the roof framing. This upgrade was designed with 1997 UBC and 1998 OSSC seismic loads. Note that this work was shown in the construction documents. However, site observations provided no evidence that the connections were installed per the drawings, and thus we were not able to confirm these elements were seismically retrofitted.

The most recent addition was built in 2008 and has two major add-ons, the first being an expansion of the administration area from the original building, which replaced and added new roof framing and a plywood roof diaphragm. At the foundations a new reinforced slab and shallow foundation system was added for the addition with underpinning occurring at the existing foundations. The other addition was a large wing on the east side of the existing structure. This new wing is primarily wood framed and made use of wood framed shear walls for the lateral force-resisting system. Wood stud walls and steel tube columns are used as the gravity system supporting wood glulam beams at the roof with a plywood diaphragm. A new reinforced concrete foundation and floor system was constructed to match the existing foundations. This addition conformed to the 2006 IBC for its seismic design loads.

<u>Seismic Assessment</u>

The Tier 1 checklists from ASCE 41-13, Seismic Evaluation and Retrofit of Existing Buildings, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Vertical reinforcement in the exterior masonry shear walls are spaced too far apart.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- There are areas of the structure, primarily at the original building, that have greater than 24-ft diaphragm spans.
- The roof diaphragm has elevation changes which affect the continuity of the diaphragm.
- The lateral elements at the mechanical penthouses are not continuous to the foundations.
- In-plane and out-of-plane connections are lacking across the majority of the structure (outside of the 2008 addition) at the roof lever per inspection.
- Cantilevered columns at 1974 covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- Ties between foundation elements at 1974 play shelter do not exist. Asphalt paving possibly restrains footings.
- Standalone 1989 covered play area has lateral support in only one direction.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Ceilings need lateral bracing in the 1974, 1977, and 1986 areas.
- Fire suppression and other piping is not laterally braced.
- Various mechanical and kitchen equipment on the roof is not anchored down.
- No seismic joints between additions.

Additional Structural Observations

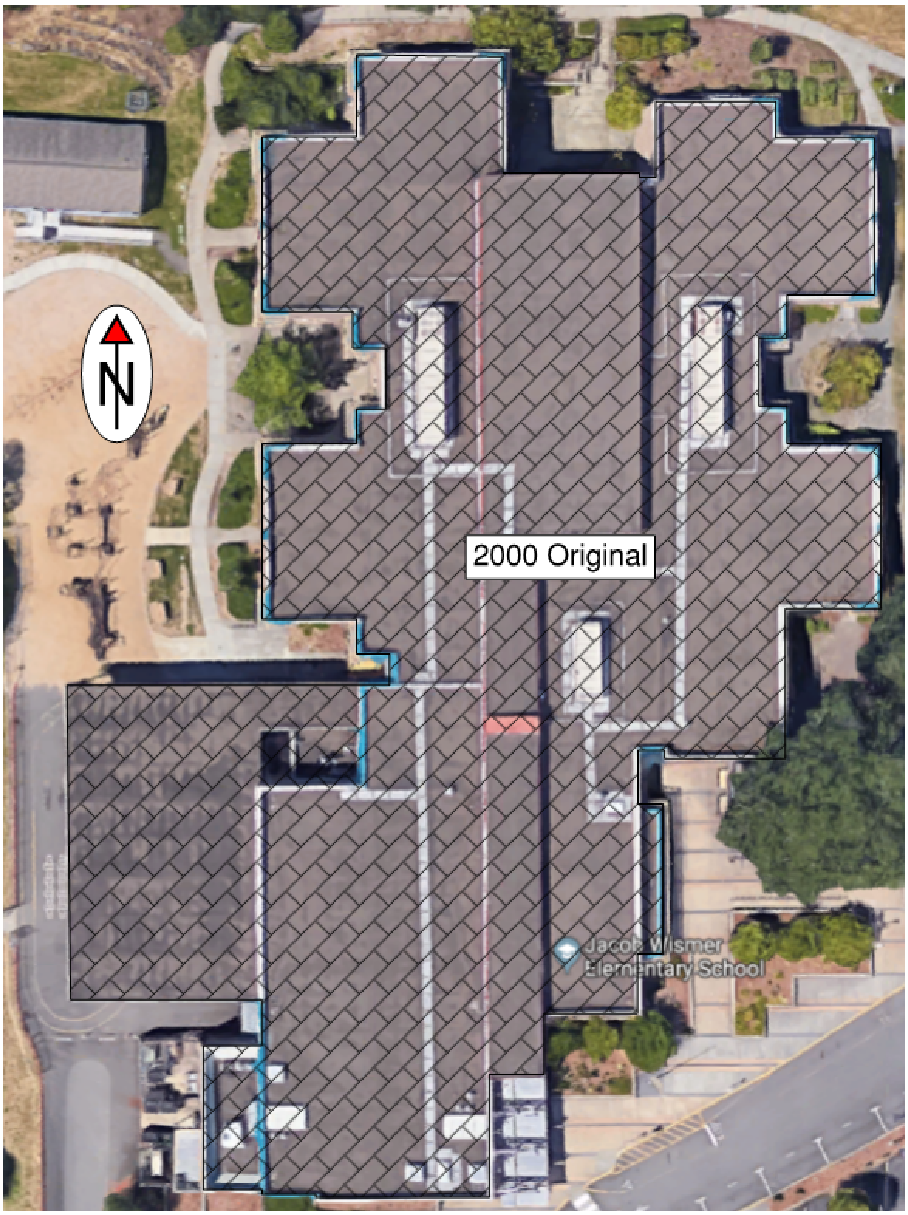
- Potential slab settlement between the 1974 original building and 1977 addition and at the northwest entrance of the gymnasium. Potential cracking observed under floor finishes.

16: Jacob Wismer Elementary School

Building Summary and Building Year Plan

Jacob Wismer Elementary School was constructed in 2000. The lateral force-resisting system for this two-story structure are primarily wood framed shear walls with plywood sheathing (W2). The roof and floor diaphragm are built with plywood decking tying into the shear walls.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

This two-story structure includes multiple classrooms, a gymnasium, cafeteria, and covered play area. The primary gravity system for this structure is comprised of wood framed bearing walls and steel tube columns. The roof framing is constructed mainly of wood joists, built-up wood girders, steel joists, and steel beams. There are also various concrete and masonry walls being used as gravity elements. These members support plywood and metal decking that is used at the roof diaphragm. The first floor of the building also contains a plywood diaphragm that connects to the lateral elements. The lateral force-resisting system consists primarily of wood framed shear walls with plywood sheathing.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Most detail drawings are not available, including most foundation details, and many of the roof and first floor connections to the lateral force-resisting system.
- Roof pop-ups may create discontinuous diaphragm elements.
- Large continuous windows at roof pop-ups that make lateral force-resisting system discontinuous to roof diaphragm.
- Library windows on the north side do not appear to have adequate lateral resistance for in-plane and out-of-plane forces.
- Cantilevering masonry walls near covered play area, unclear if reinforced.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

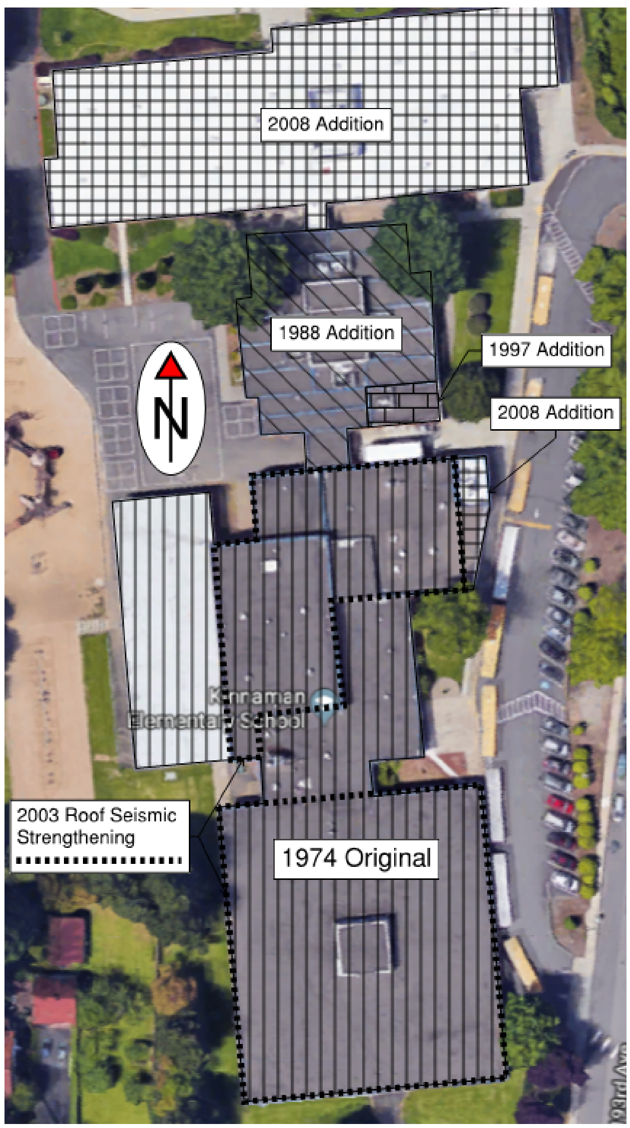
- Many tall cabinets are not attached to the walls, nor anchored into floor, and are prone to falling over.
- Overhead glazing may be a hazard.

17: Kinnaman Elementary School

Building Summary and Building Year Plan

Kinnaman Elementary School was built in 1974, with additions in 1988, 1997, and 2008, and a roof upgrade in 2003. This single-story structure contains exterior and interior reinforced masonry walls (RM1) in the original structure and all of the additions contain exterior wood framed shear walls with plywood sheathing (W2) as the lateral force-resisting system. There are also interior wood framed walls with sure board and gypsum board sheathing. The roof diaphragm contains plywood decking at all areas except the original covered play area, which is tongue and groove wood decking. The 2008 addition uses metal decking for its roof diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original building includes two separate wings, the first includes classrooms and a library and the second wing includes a cafeteria, gymnasium, bathrooms, and administration area. There is also a covered play area on the western side of the second wing. Both wings were built with exterior reinforced giant brick masonry bearing walls and interior steel and wood columns. These elements are supported by reinforced concrete shallow foundations and a slab-on-grade floor system. The foundations are anchored and connected into the lateral force-resisting system. The lateral force-resisting system uses the exterior masonry giant brick shear walls as well as some interior masonry walls in the northern wing. The diaphragm at the roof level is made up of plywood sheathing across the entire structure, except the covered play area which is straight sheathed wood tongue and groove decking. Wood glulam beam and joist framing is used at the roof level to support the diaphragm.

The 1988 addition consists of a classroom wing on the north side of the original structure. This addition uses a shallow reinforced concrete foundation system supporting steel tube columns, wood posts, and wood stud walls. The floor system for this addition differs from the original structure in that it uses a plywood sheathed floor supported by wood posts and joists rather than the concrete slab-on-grade. The wood posts do bear on the concrete foundations but lack positive connections to those foundations. The lateral force-resisting system for this addition is made from exterior wood shear walls using plywood sheathing. The roof diaphragm is built with plywood decking. There is a large clerestory pop-up area in the roof of this addition.

For the 1997 addition, a new classroom area was added to the previous 1988 addition on the southeast corner. This is a small area that matches the previous additions construction using a plywood floor system while bearing on shallow concrete foundations. New exterior wood shear walls were also installed to provide lateral support to this area. Wood beams and joists were used at the roof framing to provide support for the plywood roof diaphragm.

A seismic roof upgrade was done in 2003 that added newly upgraded connections to the original building. These connections consisted of adding new strapping on top of the existing plywood near the exterior shear walls, and new anchorage to the exterior shear walls from the plywood sheathing. No new plywood sheathing was added per the structural drawings.

The 2008 addition added a large classroom wing to the north side of the previous addition and also made a renovation to the front entry area at the original building. The main classroom area is similar to the original building as it has a concrete slab-on-grade floor system with reinforced concrete foundations supporting the remainder of the structure. The gravity system for this addition consists of exterior metal stud bearing walls with brick veneer in some areas, interior metal stud bearing walls, built-up wood columns, and tube steel columns. These vertical elements support a steel roof framing system comprised of steel beams and joists which support the metal deck roof diaphragm. The roof diaphragm connects to metal stud shear walls with plywood sheathing for the lateral force-resisting system. A seismic joint is present between the 2008 addition and 1988 addition. It should be noted that the seismic joint was at the roof structure, but did not continue to the ground.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Vertical reinforcement in the exterior masonry shear walls are spaced to far apart.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- There are areas of the structure, primarily at the original building, that have greater than 24-ft diaphragm spans.
- Columns and wood bearing walls likely do not have shear capacity to provide efficient support against lateral loads.
- Wood posts do not have a positive connection to the foundations in the 1988 addition.
- Geologic site hazards such as Liquefaction, Slope Failure, and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.
- Steel and built-up wood gravity columns likely are not adequate to provide shear resistance from lateral loads.
- The pop-up roof at the 1988 addition has long continuous windows on both sides of the long direction.
- Likely unreinforced cantilevered masonry walls near covered play area are potential falling hazards.
- Mechanical penthouse at original building is not continuous to the foundations to provide lateral support.
- Covered Play area at Original 1974 building needs an upgraded roof diaphragm to replace the current wood decking.
- The roof diaphragm has elevation changes which may affect the continuity of the diaphragm.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Seismic joint between 2008 and 1988 additions did not continue all the way down from roof.

18: McKay Elementary School

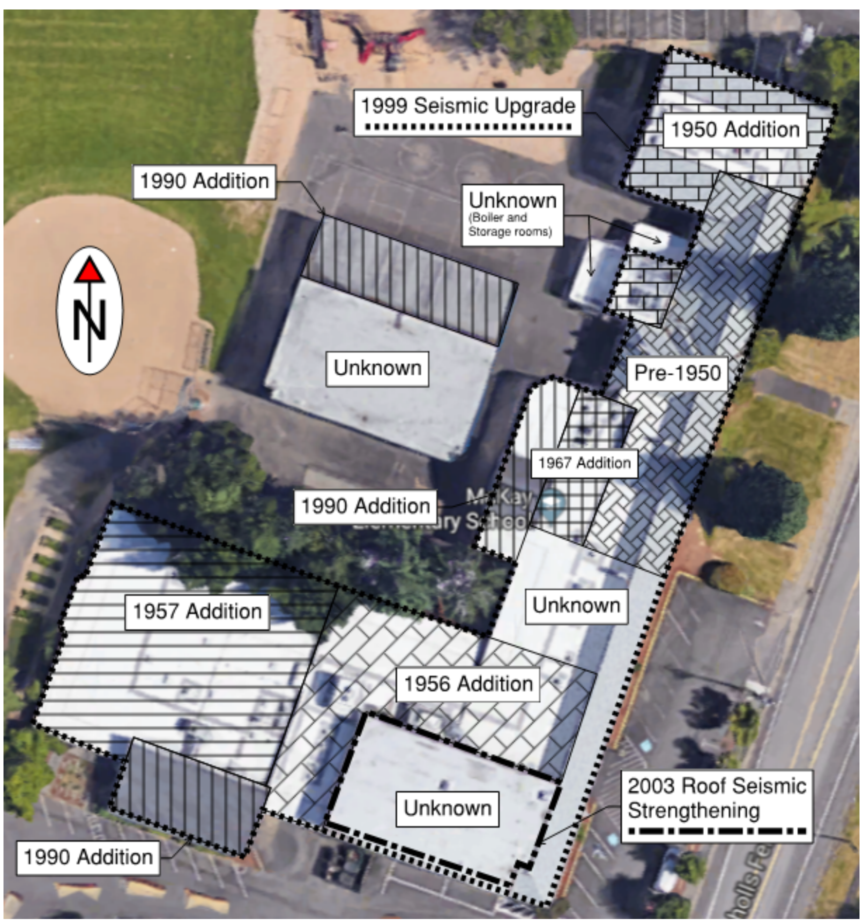
<u>Building Summary and Building Year Plan</u>

McKay Elementary School was originally constructed before 1950 (exact year is unknown, referenced as 1929 in 1999 drawings) with subsequent additions in 1950, 1956, 1957, 1967, and 1990. There were also two seismic upgrades done in 1999 and 2003, respectively.

Note: There are two other additions that have no existing drawings that could be located, and their construction years are unknown. These additions have been referenced as 1946 and 1955 in the 1999 drawings but cannot be confirmed.

The numerous additions and original structure all use wood framed shear walls (W2) for the lateral force-resisting system. All areas have either wood decking or plywood diaphragms from either their original construction and/or seismic roof upgrades. The standalone covered play area has cantilevered wood posts and a wood decking roof diaphragm that act as the lateral force-resisting system.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original building was built sometime before 1950 and is a two-story structure with multiple classrooms, offices, and a library area. There are no existing drawings available, but through visual observations it can be seen that the first story/basement exterior walls are concrete with wood framed walls at the second story. The exterior of the structure is stucco siding with plywood backup. The original sloped roof structure appears to be a wood decking diaphragm with a built-up roofing system.

The 1950 addition consists of two separate areas, one being a two-story addition to the north of the original building that added new classrooms, and the other to the west of the original building that added a storage/mechanical area. The two-story area is connected to the original building and uses concrete walls at the lower level with wood framed walls on top with stucco and plywood sheathing. The smaller storage/mechanical area has masonry walls with steel column backup to support the wood framing with a wood decking roof diaphragm. Glass block is present on the north and east sides of the 1950 addition and is a significant falling hazard.

The addition in 1956 added new classrooms to the south side of the original building. This addition is built using wood framing throughout including wood bearing and shear walls, wood post columns, glulam beams and a wood decking roof diaphragm. The foundation system for this addition is comprised of reinforced concrete shallow foundations with a concrete slab-on-grade floor.

The 1957 addition consists of more classrooms to the west of the 1956 addition. This addition is built very similar to the 1956 addition, as it uses wood posts and bearing walls to provide gravity support while gypsum sheathing is used at the wood shear walls. The roof diaphragm is straight board wood decking. The foundations are shallow reinforced foundations and a reinforced concrete slab-on-grade.

The 1967 addition added a small library area to the southwest of the original building. This addition has exterior wood bearing/shear walls with plywood sheathing as the lateral force-resisting system. The roof diaphragm is also plywood decking. The floor system at this addition is a raised plywood floor with wood posts and glulam beams at the central area supporting it.

The 1990 addition consists of three different areas, a cafeteria area at the south side of the 1957 addition, a library expansion at the west side of the 1967 addition, and a covered play area to the north of the existing covered play area. Both the cafeteria and library expansions have a concrete slab-on-grade floor system with shallow concrete foundations. The exterior walls all have plywood sheathing and act as shear walls while plywood decking is used for both roof area diaphragms. The covered play area expansion is similar to the existing structure in that it uses wood posts with straight wood decking and glulam beams. This covered play area roof is lower than the original play area.

The 1999 seismic upgrade added new connection improvements to the original structure and most of the subsequent additions that improved the connections at the roof and second floor levels. The upgrade also constructed and added new shear walls in the 1956 and 1957 additions.

The most recent seismic improvement to this school was completed in 2003, and consisted of strengthening the existing wood roof diaphragm of the gymnasium by adding a plywood deck to provide lateral restraint across this area. Simpson hold-downs were also installed at the roof level above the stage to tie the roof together at a roof step. During on-site visual observations, new HSS out-of-plane bracing was observed in the boiler room (unknown year of construction) for the CMU walls.

The gymnasium area, covered play area, and central classrooms do not have existing drawings and the original years of construction are unknown. Visual on-site observations were completed at all of these areas and any deficiencies found are listed below.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete foundation walls are not adequately anchored to diaphragms for out-of-plane forces at original construction and additions (some locations were strengthened in 1999 but might not meet current standards).
- Connections between concrete walls and wood shear walls at original building do not have adequate in-plane connections.
- Concrete foundation walls at original structure likely do not have proper reinforcement and have tall narrow piers between windows.
- 1950 wood posts do not have a positive connection to the foundations or the wood framing at the second floor.
- Many interior and exterior shear walls only have gypsum board sheathing rather than plywood sheathing and require strengthening.
- Additional shear walls are likely required to meet the performance criteria of current codes.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.

- Cross ties at roof diaphragm will likely need to be strengthened.
- Wood ledgers are in cross-grain bending at some roof connections.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- The wood posts at the covered play area were observed to have significant splitting.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

<u>Summary of Seismic Nonstructural Deficiencies</u>

- Ceilings do not have lateral bracing wires.
- Original or nonannealed overhead glazing can be a hazard.
- Exterior glass block on the 1950's addition north façade and part of the east façade is a falling hazard.
- No seismic joints between additions.

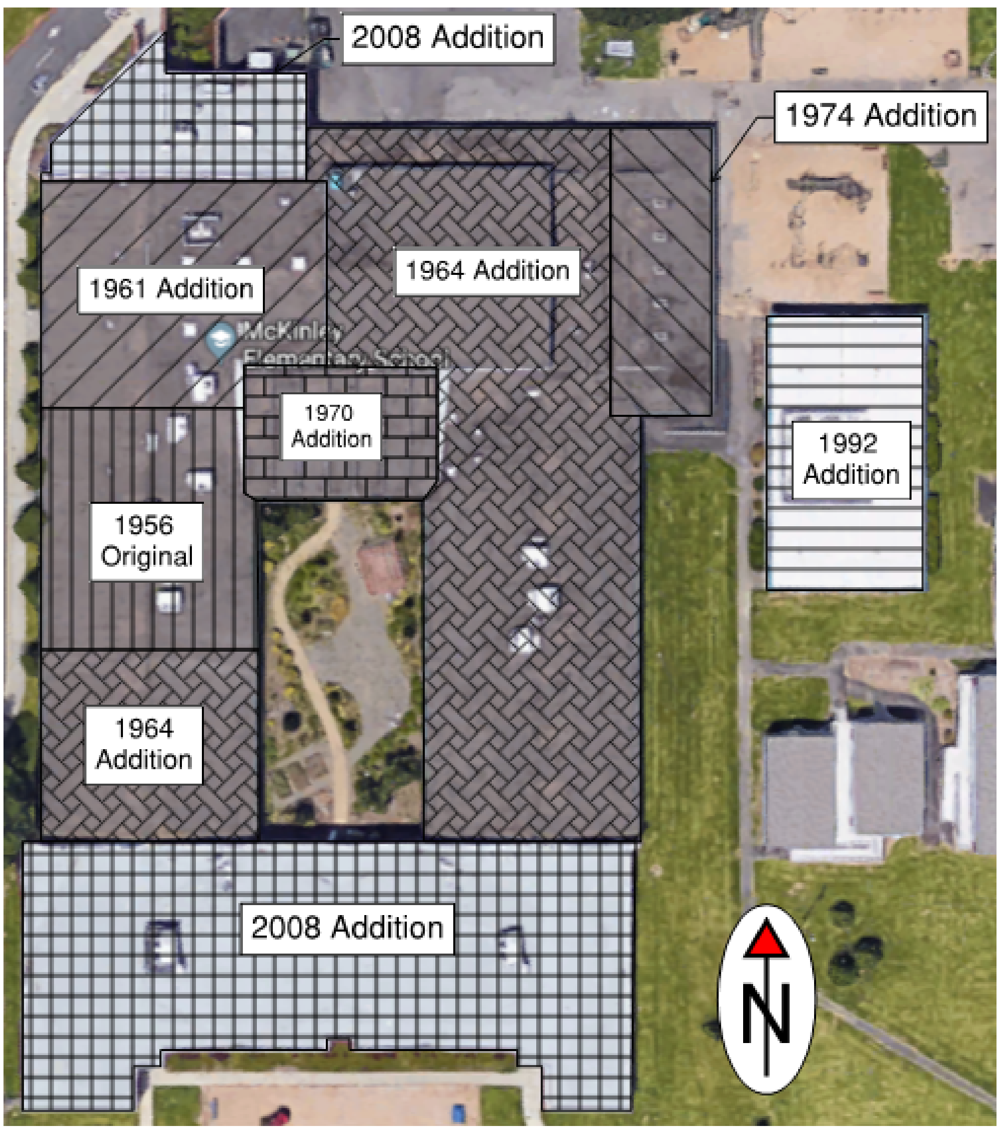
19: McKinley Elementary School

Building Summary and Building Year Plan

McKinley Elementary school was built in 1956, with additions in 1961, 1964, 1970, 1974, and 2008, with a standalone building addition in 1992.

The primary lateral force-resisting system for this single-story structure is exterior and interior wood framed shear walls (W2) using plywood and gypsum board sheathing. Straight board wood decking serves as the roof diaphragm for the 1956 original building and plywood or “plyscord” sheathing is used at all other roof diaphragms per the existing drawings.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



ELEMENTARY SCHOOLS | MIDDLE SCHOOLS | HIGH SCHOOLS | OPTION SCHOOLS | SUPPORT FACILITIES

<u>Building Description (separated by construction phases)</u>

The original 1956 structure consists of classrooms, bathrooms, and an outdoor covered play area. This portion of the structure uses wood framed bearing walls and wood posts for the gravity system. The roof system consists of glulam beams supporting a straight sheathed wood decking. The lateral force-resisting system is wood framed shear walls with gypsum board sheathing. The original covered play area was demolished while building the 1961 addition. The roof system is continuous over the covered play area and the rest of the original structure. A reinforced concrete foundation and floor system are used to support all of the above elements; the bearing and shear walls are tied into the foundations. An asphalt floor system was used at the covered play area but then replaced in the 1961 addition. The wood post columns do not have a positive connection and may allow for upward forces to make the structure unstable.

The 1961 addition included new classrooms, a kitchen, and a large multipurpose room which serves as a cafeteria. This addition followed the previous structural design by using the same type of wood framing throughout the building as the original structure, but used Plyscord wood sheathing for the roof diaphragm. There is also an exterior masonry wall present at the west side of this addition. The lateral force-resisting system is made up of wood framed shear walls with gypsum board sheathing.

The addition in 1964 more than doubled the building footprint adding new classrooms, a stage area which connects to the previous cafeteria, and a gymnasium with locker rooms. The foundations are built from shallow concrete foundations tying into the existing foundations and provide support for the all new wood framing in this addition, including the gymnasium. The lateral force-resisting system is primarily plywood sheathed shear walls. Note that there are some smaller areas where gypsum sheathing is also being used. Tectum was present in the gymnasium on the ceiling and at the top of the walls. The original structural drawings note Plyscord sheathing on the roof of the gymnasium, so the Tectum doesn't appear to act as the diaphragm. However, this Plyscord could not be visually observed. The roof system is Plyscord sheathing exclusively across the entire addition.

The 1970 addition added a small classroom and office area at the center area of the existing structure. This small addition attaches to the previous additions by using a reinforced concrete floor and foundation system that ties into the previous construction. The roof system is built with glulam beams and plywood sheathing. The lateral force-resisting system uses wood shear walls with gypsum board sheathing.

The 1974 addition added an expansion to the covered play area on the northeast corner of the existing structure. This addition uses glulam columns supported by concrete foundations to support a new plywood roof system. Asphalt pavement is below the covered play area which does not tie into the foundations. There is no dedicated lateral force-resisting system for this area other than the cantilevered wood posts, though it does tie back into the main structure at the roof along one side.

The final addition from 2008 added new classrooms and bathrooms to the south end of the existing structure. The exterior of this addition is made up of wood bearing and shear walls with an exterior brick veneer. All shear walls in this new addition use plywood sheathing exclusively. The roof diaphragm uses plywood decking and is supported by glulam beam framing. On the interior of the addition there are wood framed walls as well as steel tube columns to provide gravity support.

The standalone structure on the east side was built in 1992 and added a few classrooms and bathrooms separate from the main structure. Per the drawings, the structure is built using exterior wood walls and interior tube steel columns. The exterior wood walls are designed as shear walls using plywood sheathing. The roof framing consists of glulam beams and wood joists supporting a plywood deck roof diaphragm. The foundation and floor system are both reinforced concrete.

Note: There was a structure prior to 1956, per the existing 1956 drawings, which appears to have been replaced by the 1956 structure. All subsequent additions were added onto the 1956 building.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Many wood framed shear walls are using gypsum board sheathing. These should be strengthened with plywood.
- Wood framed walls and foundations are missing positive connections in multiple areas.
- Many shear walls to roof diaphragm connections are not adequate.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- There are many roof discontinuities between additions that make the roof diaphragm discontinuous.
- The wood decking and plywood roof diaphragms may need to be strengthened at all areas except the 2008 addition.
- Wood posts in the crawl space do not have a positive connection to the foundations at the 1992 addition.
- Ties between foundation elements at play shelter does not exist. Asphalt paving possibly restrains footings.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.

- The covered play area is not tied back to the building and needs strengthening.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Fire suppression and other piping requires lateral bracing.
- Various roof equipment is not anchored down or braced laterally.
- Overhead high window glazing around much of the exterior appears to be original and is hazardous.
- No seismic joints between additions.

20: Montclair Elementary School

Building Summary and Building Year Plan

The Montclair Elementary School was built in 1969, with additions in 1992 and 1998, and a seismic roof upgrade in 1997.

The building is a single-story reinforced masonry (RM1) structure with plywood sheathing and wood decking at the roof level. The 1992 standalone addition has exterior wood framed shear walls (W2) with an OSB roof diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The original 1969 building consists of a large classroom wing on the east side and a combination of a cafeteria, gymnasium, administration, and outdoor covered play area on the west wing. The gravity system uses exterior and interior masonry bearing walls along with some interior wood framed walls. These elements were supported by a concrete slab-on-grade floor system and reinforced concrete shallow foundations. Roof framing consists of glulam beams, wood joists, and some steel girders and joists. The lateral force-resisting system consists of reinforced masonry walls at the exterior and interior. The roof diaphragm is tongue and groove wood decking and plywood decking.

The addition in 1992 is a standalone structure to the west of the existing building and consists of a few new classrooms and small bathrooms. It was built using exterior wood framed shear walls with plywood sheathing, interior steel columns, and a wood framed roof. The roof diaphragm is OSB spanning across the entire structure. The foundations are reinforced concrete shallow foundations and the floor is a reinforced concrete slab-on-grade.

The addition in 1998 added a library area to the east side of the original structure. There is a large curtain wall on the far east side. This addition was built with steel girders supporting TJI roof joists and a plywood roof diaphragm. New wood framed shear walls were added with plywood sheathing on the north side of the addition. The foundation system was built to match the existing including a new concrete slab-on-grade floor and shallow foundations that tie into the previous construction.

The seismic roof upgrades in 1997 replaced all of the original structural decking with a new plywood diaphragm except at the covered play area. It also updated some of the previous connections to the roof diaphragm by improving the in-plane and out-of-plane lateral resistance.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior masonry walls do not have a positive connection into the foundations or concrete floor diaphragm and will not provide sufficient out-of-plane support.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Wood posts do not have positive connections to the foundations.
- Some interior wood shear walls use gypsum board as primary sheathing.
- Roof diaphragm has split level areas and consist of non-continuous areas.

- Some areas of the wood decking roof diaphragm span longer than 24 ft.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- Covered play area may need a new plywood decking roof diaphragm.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture unknown but are likely not a deficiency for this site.

<u>Summary of Seismic Nonstructural Deficiencies</u> (included in cost per square foot above)

- Fire suppression and other piping is not braced laterally.
- Ceilings need to be braced in the original 1969 building.
- Original overhead glazing is hazardous and should be replaced.

21: Nancy Ryles Elementary School

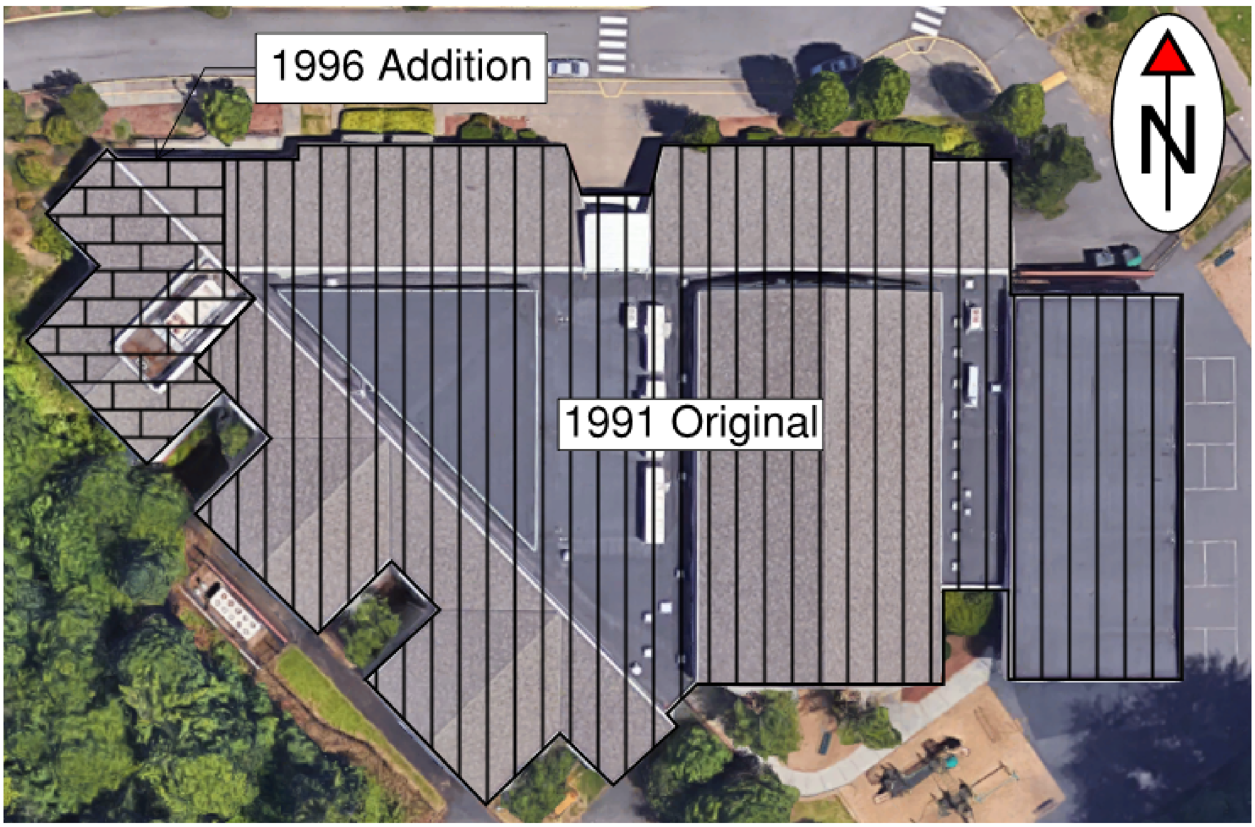
Building Summary and Building Year Plan

Constructed in 1991, with an addition in 1996. The following schools are very similar in plan and in detailing:

- Findley Elementary School
- Nancy Ryles Elementary School
- Scholls Heights Elementary School

Both the original 1991 structure and the 1996 addition are wood framed two-story construction (W2) with flexible plywood floor and roof diaphragms. A reinforced masonry shear wall separates the gymnasium from the covered play area on the east side of the building.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1991 structure includes two classroom wings, administrative areas, a commons/library space, a gymnasium and a covered outdoor play area. The building is located on a sloped site that drops off to the southeast. The gravity system in typical classroom and administrative areas consists of plywood floor sheathing, wood joists, and wood framed bearing walls. Larger spans including the library/commons are framed with plywood sheathing, glulam beams and steel columns. The gymnasium is framed with steel open web trusses and steel columns. The roof diaphragm is made of plywood sheathing and has blocked adjacent to shear walls that are parallel to the direction of joist framing. The main lateral force-resisting system consists of plywood or gypsum wallboard bearing and shear walls distributed around the perimeter and throughout the interior of the building. Shear walls are anchored to the foundation with equally spaced anchor bolts along the length of each wall. A covered play area at the east side of the structure is supported by a reinforced masonry shear wall (RM1) along adjacent to the gymnasium.

A 1996 addition added wood framed classrooms with wood shear walls to the northwest corner of the building. No seismic joint is apparent between the original structure and the 1996 addition. A Simpson hold-down anchor system is used at the end of shear walls that are part of the 1996 addition.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- The roof diaphragm is discontinuous and has several pop-up areas, including the roof at the library/commons. This results in a discontinuous lateral load path.
- Roof chords are discontinuous at sloped roof pop-ups.
- There is not a collector element to drag the southern portion of the cover play area roof into the main structure roof diaphragm for lateral loads in the east-west direction.
- Roof diaphragm contains plywood but is not blocked in all locations. Further analysis is required to determine extent of seismic retrofitting required.
- Gypsum wallboard is use for shear walls (marked “S” in the drawings) in several locations throughout the 1991 structure.

- Overturning hold-downs are not shown for shear walls in the 1991 original building.
- Walls along southwest elevation do not have straps or collectors to carry seismic forces into other walls. Large window openings leave minimal continuous shear walls along this elevation.
- Glulam girders around perimeter of library pop-up are not continuous and have not been strapped/tied to act as chords.
- The reinforced masonry shear wall is anchored to the high covered play and gymnasium roof diaphragms with a wood ledger connection that may lack the required strength to support the wall for out-of-plane forces.
- The existing drawings show the vertical reinforcement in the masonry shear wall ending at the bottom of the covered play area beams and not extending to the top of the wall.
- The reinforced masonry shear wall has #5 bars in each cell on each face, but only has a single row of dowels connecting it to the foundation.
- Geologic site hazards such as Liquefaction, Slope Failure, and Surface Fault Rupture are unknown. Slope failure could be an issue at this site.

<u>Summary of Seismic Nonstructural Deficiencies</u> (included in cost per square foot above)

- Tall kitchen equipment and shelving require anchorage in case of seismic event to prevent overturning.
- Fire suppression and other piping require lateral bracing.
- Large overhead glazing at library area may be hazardous.

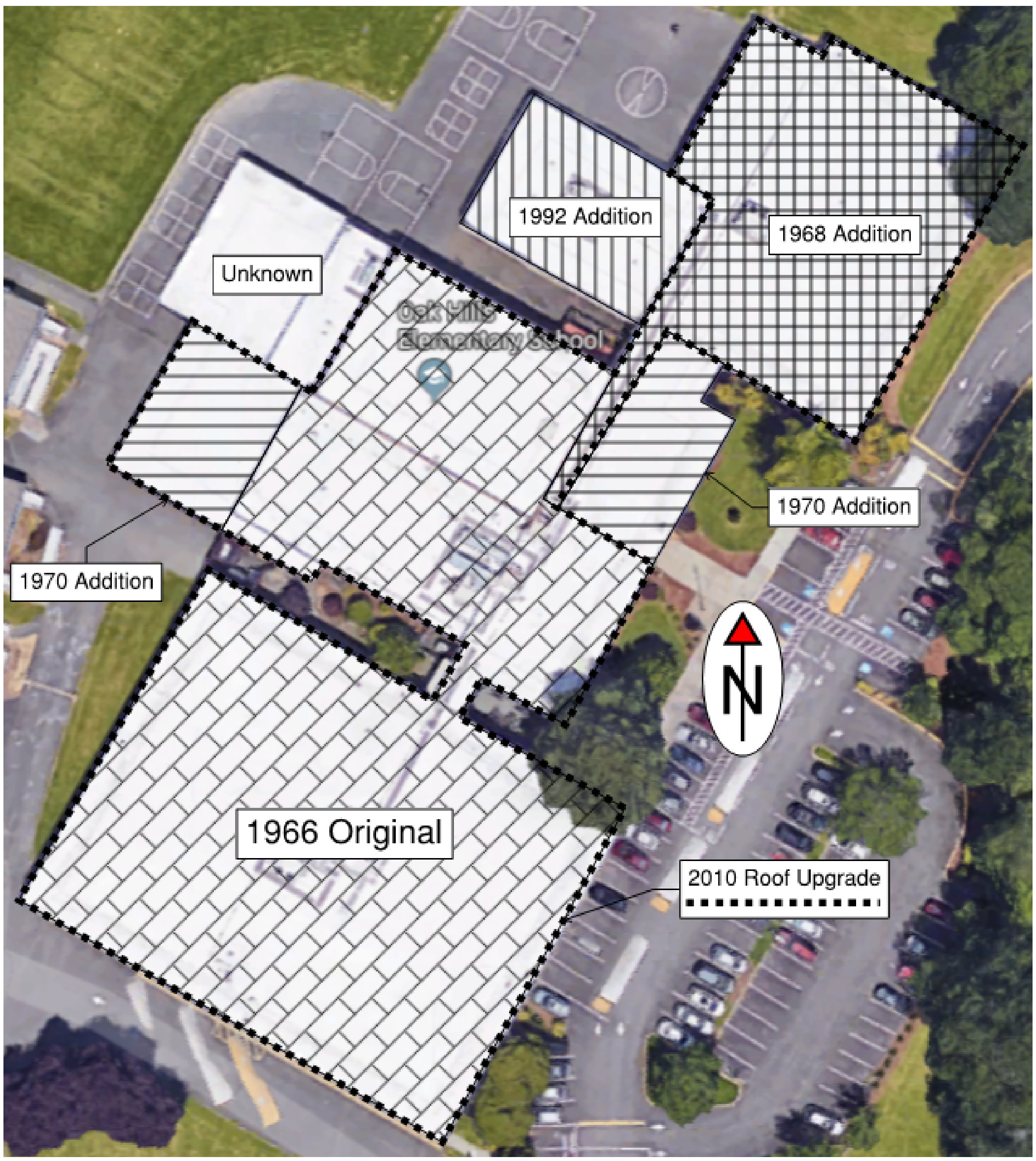
22: Oak Hills Elementary School

Building Summary and Building Year Plan

Oak Hills Elementary School was built in 1966, with additions in 1968, 1970, and 1992; and a seismic roof upgrade in 2010. There is also a covered play structure with an unknown date of construction.

This single-story structure's lateral force-resisting system is made up of exterior masonry walls (RM1) and interior wood framed shear walls (W2) with straight board wood decking and plywood roof diaphragms.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by phases)

The original 1966 construction consists of a large classroom wing, cafeteria, gymnasium, administration, and covered play area. The gravity system for this building included exterior reinforced masonry walls, interior wood framed walls, and steel columns. These elements are supported by a concrete shallow foundation system and a slab-on-grade floor system. The roof framing is made up of glulam beams, steel girders, and steel joists over the gymnasium and cafeteria areas. The lateral force-resisting system in the original building is primarily exterior reinforced masonry walls, with some gypsum board shear walls at the interior. The roof consists of a plywood diaphragm.

The 1968 addition added a new classroom wing with an attached covered play area to the north side of the existing structure. This addition was built very similar to the original structure by using exterior masonry walls, interior wood framed walls and steel columns to support gravity elements. The lateral force-resisting system is the same as well, including exterior reinforced masonry shear walls and interior shear walls with gypsum board sheathing. The roof diaphragm consists of plywood decking. The covered play area has an asphalt paved surface that likely does not restrain footings.

The 1970 addition is located on the east side of the existing structure and serves as a classroom and conference room expansion. There is also a covered play area to the west of the gymnasium that was added in this addition. The structure here is directly connected to the existing 1966 and 1968 buildings. This addition is built in a similar manner to the previous construction with wood framed walls and steel columns supporting a wood decking diaphragm.

The addition in 1992 added a new multi-classroom area connecting to the west side of the 1968 addition. This addition is built with exterior wood framed walls and interior steel tube columns supporting glulam beams and TJI roof joists. The roof diaphragm on this addition consists of an OSB panel diaphragm. Plywood sheathing is used at all exterior wood shear walls. The foundation system is a shallow reinforced concrete foundation and a concrete slab-on-grade floor. These systems are not tied together.

The seismic roof upgrade in 2010 consisted of adding new plywood sheathing over the majority of the existing wood decking in the original building. New connections were also added between existing roof diaphragms and lateral elements to strengthen the lateral resistance for in-plane forces.

The region labeled “unknown” to the west of the gymnasium is a covered play area and locker/storage area that was added in an unknown year post-1970. The covered play area has cantilevered steel columns with a wood roof structure that appears to be similar to the 1970 covered play area. The locker/storage area is exterior masonry walls and tie into the existing exterior gymnasiums masonry walls.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Re-entrant corners lack sufficient tensile capacity to the develop strength of diaphragm.
- Interior wood shear walls use gypsum board as primary sheathing rather than plywood.
- The floor diaphragm does not tie into the foundations or interior and exterior shear walls at the 1966, 1968, and 1970 phases.
- Connection between the masonry shear walls and roof diaphragm lack out-of-plane support.
- Some areas of the roof diaphragm with wood decking span longer than 24 ft.
- 1970 addition and covered play area may need a new plywood decking roof diaphragm to strengthen existing wood decking.
- Wood ledgers at roof joist connections may be under cross-grain bending.
- The covered play areas have cantilevered columns that were likely not designed for lateral loads.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Additional shear walls are likely required to meet the performance criteria of current codes.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Ceilings require lateral bracing in 1966, 1968, and 1970 areas.
- Lights do not have independent support.
- Some heavy partition walls do not have ceiling support bracing.

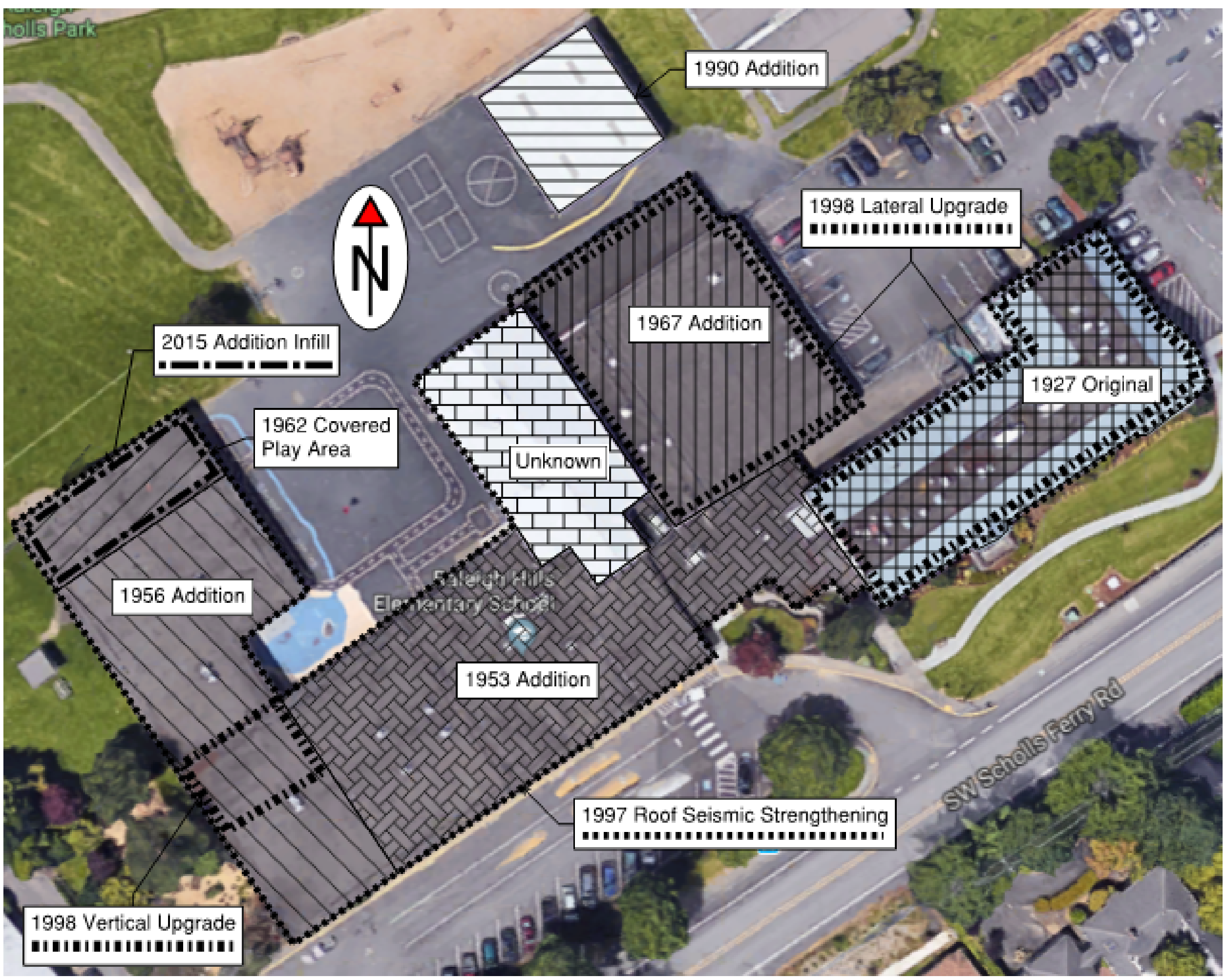
23: Raleigh Hills (K-8) School

Building Summary and Building Year Plan

The Raleigh Hills School was built in 1927, with additions in 1953, 1956, 1962, 1967, and 2015. The gymnasium was built between 1927 and 1953, although the exact year is unknown. The standalone covered play area was built in 1990. There was a seismic roof upgrade in 1997 and a lateral upgrade in 1998.

Wood framed shear walls (W2) with plywood and gypsum board sheathing are used as the primary lateral force-resisting system for all areas of this structure. The roof system was originally tongue and groove decking, but plywood decking was likely added in subsequent roof upgrades. The standalone covered play area uses steel moment frames in one direction with a metal decking diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1927 building is a two-story structure with multiple classrooms, offices, and a library area. There are no existing drawings available but through visual observations it can be seen that the first story exterior walls are likely unreinforced concrete with wood framed walls at the second story. The brick seen on the exterior is veneer and not loadbearing, but also does not appear to have proper tieback to the structure. The original sloped roof structure appears to be a straight board wood decking diaphragm.

The gymnasium was built sometime between 1927 and 1953, but it is unknown exactly when and no drawings are available for reference. There are wood trusses connecting to wood post columns in one direction across the gym. The roof appears to be original wood decking that was upgraded with plywood sheathing in the 1997 roof seismic strengthening upgrade.

The 1953 addition consists of a single-story structure which includes a classroom wing and an administration area. The gravity system consists of exterior and interior wood framed bearing walls. The foundations supporting these elements are reinforced concrete shallow foundations and a reinforced concrete slab-on-grade. The roof framing consists of glulam beam girders and wood joists. The roof diaphragm is tongue and groove wood decking. The lateral force-resisting system uses exterior wood framed shear walls with gypsum board sheathing.

The addition in 1956 added new classrooms and a covered play area on the west side of the 1953 addition. This addition uses exterior and interior wood framed walls for the gravity system. Many of these walls are sheathed with gypsum board and also act as the lateral force-resisting system. The foundations are reinforced concrete shallow foundations and slab-on-grade floor. There are no seismic joints between the additions.

In 1962 a covered play area was added onto the north side of the 1956 addition. This covered play area was built with wood posts, glulam beams, and tongue and groove decking roof diaphragm. This area was later infilled in the 2015 addition.

The 1967 addition added a large multipurpose room, kitchen, and outdoor covered play area. This addition uses shallow reinforced concrete foundation walls to support the exterior wood framed bearing walls, as well as the steel tube columns that support the covered play area. The roof framing consists of wood glulam beams with intermittent joists. The lateral force-resisting system consists of exterior plywood sheathed shear walls. The covered play area does not have a specific lateral force-resisting system but does tie into the rest of the structure on one side.

The 1990 standalone covered play area is a steel framed structure with a metal roof deck. The lateral force-resisting system for this structure is a series of moment frames in one direction with no frames acting in the perpendicular direction.

The 2015 addition infilled the 1962 covered play area and added new classrooms. The new walls are built with wood framing and plywood sheathing and act as both the lateral and gravity systems. New plywood decking was added on top of the original wood decking. The existing concrete foundations were reused, but new concrete stem walls were constructed on top of the existing footings. The reinforced concrete floor system in this area is entirely new per this addition and replaced the asphalt surface.

The 1997 roof upgrade added new plywood sheathing across all existing roof areas except for the standalone covered play area and roof area over the kitchen. Connections from the new sheathing to existing lateral elements and decking were added to provide support for in-plane forces while out-of-plane forces may need further upgrades to be adequate.

Additional work was performed in 1998 and consisted of lateral element upgrades in the original structure, 1956 addition, and 1967 addition. These upgrades consisted of adding new shear transfer elements, new foundation anchorage, and new plywood sheathing to shear walls that did not previously have plywood sheathing.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete foundation walls are not adequately anchored to diaphragms for out-of-plane forces at original construction and additions.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Concrete foundation walls at original structure do not have proper reinforcement. A scan of the wall for reinforcement was completed as part of the 2018 design work and no reinforcement was found.
- Cross ties at roof diaphragm will likely need to be strengthened.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Exterior brick veneer at the original structure likely does not have ties back to the structure.
- The 1967 covered play area is not tied back to the building and needs strengthening.

- Many interior and exterior shear walls only have gypsum board sheathing rather than plywood sheathing.
- Connections between concrete walls and wood walls at original building do not have adequate out-of-plane connections.
- Wood ledgers are in cross-grain bending at some roof connections.
- Additional shear walls are likely required to meet the performance criteria of current codes.
- 1990 standalone covered play area only has a defined lateral force-resisting system in one primary direction.
- Many shear walls to roof diaphragm connections do not provide sufficient out-of-plane support.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies

- Fire suppression and other piping require lateral bracing.
- Ceilings do not have lateral bracing wires.
- Lights require independent supports.
- Original or nonannealed overhead glazing can be a hazard.
- No seismic joints between additions.

Additional Structural Observations

In addition to the seismic structural deficiencies, during our assessment and site visit we discovered the use of single bolted connections in the original gymnasium trusses. A few connections showed signs of wood splitting at the member ends. We recommend a detailed evaluation and likely strengthening of the truss connections as single bolted trusses are prone to connection failures.

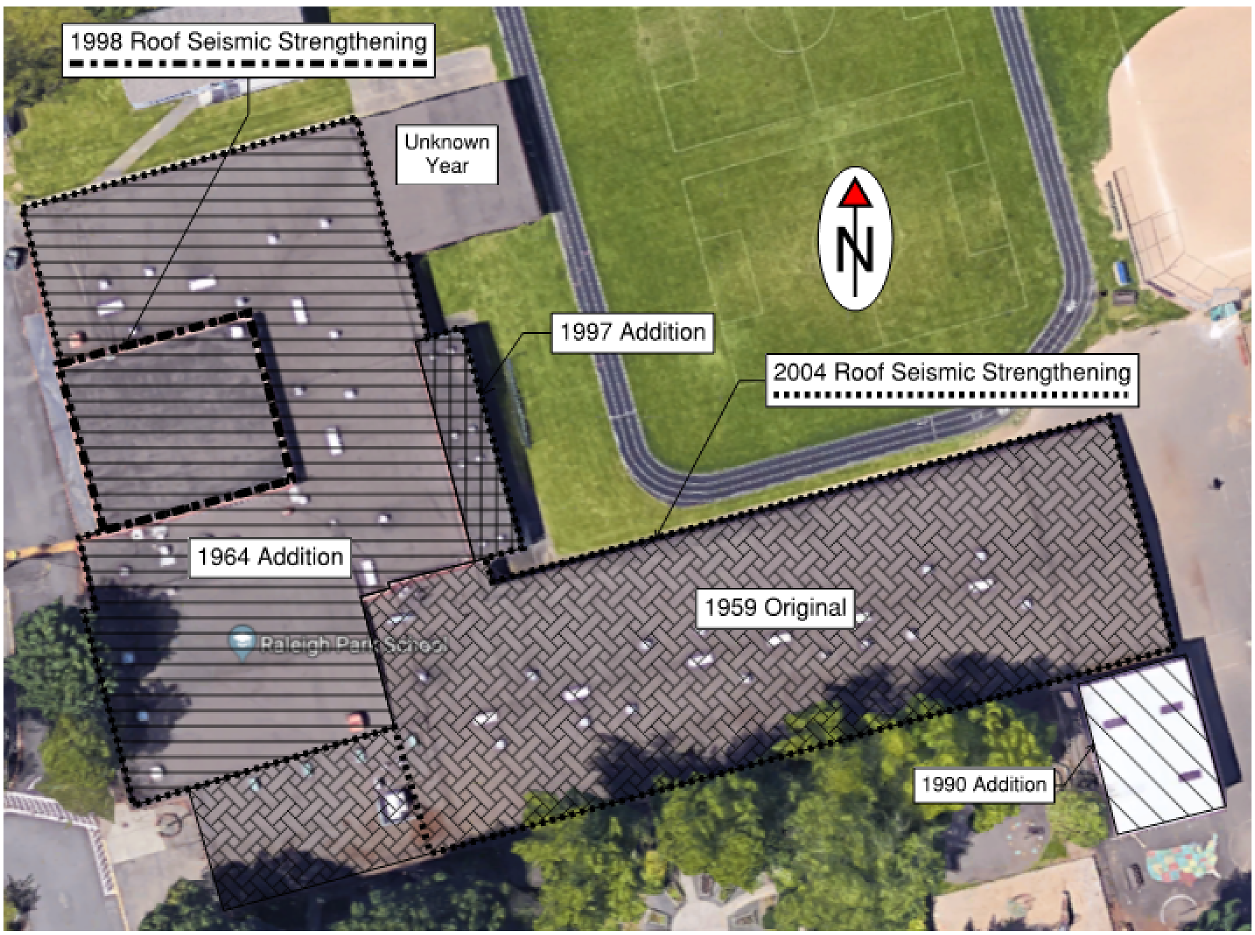
24: Raleigh Park Elementary School

Building Summary and Building Year Plan

The Raleigh Park Elementary School was built in 1959, with additions in 1964, and 1997, and a standalone covered play area in 1990. Seismic roof upgrades occurred in both 1998 and 2004.

The lateral force-resisting system for this structure is reinforced masonry shear walls (RM1) around the gymnasium and large multi-purpose room, with wood framed shear walls (W2) in the interior portions of the classroom wings. A few small exterior wood shear walls on top of partial height masonry walls are also present (mostly at the 1997 addition as well as a few areas around the original building). The roof diaphragm is constructed primarily of plywood decking over original Tectum.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1959 structure includes a large classroom wing with some small bathrooms and offices. The gravity system consists of exterior and interior wood bearing walls and steel posts supporting the roof framing. There are also concrete block walls down both sides of the main corridor that do not extend to the roof diaphragm, and a few concrete block walls at the exterior of the building that are not braced. The foundation and floor system are shallow reinforced concrete foundations and slab-on-grade, respectively. The lateral force-resisting system here uses the exterior and interior walls which are framed with plywood and gypsum board sheathing. The exterior shear walls are very limited as most of the exterior is covered in large glazing. The roof diaphragm consists of Tectum board which does not provide significant lateral resistance.

The 1964 addition added a gymnasium, large multi-purpose room, and multiple classrooms. The gravity system for this addition is concrete block walls around the gymnasium and multi-purpose areas, as well as wood framed bearing walls and posts/beams around the classroom areas. There are also concrete block walls down the corridors that do not extend to the roof diaphragm and a few concrete block walls at the exterior of the building that are not braced. The foundation system is comprised of reinforced concrete shallow foundations and a slab-on-grade floor. The lateral force-resisting system is primarily the concrete block walls around the gym/cafeteria portions of the building with additional interior wood framed shear walls, and gypsum sheathing on top of the half-height masonry walls. The roof diaphragm is a Tectum board decking originally. Plywood was added at later upgrades.

The 1990 standalone covered play area is a steel framed structure with a metal roof deck. The lateral force-resisting system for this structure is a series of moment frames that only go in one direction with no support in the perpendicular direction.

The addition completed in 1997 added to the existing library on the east side of the 1964 addition. This addition uses a reinforced concrete slab-on-grade and shallow foundations to support wood posts and exterior wood bearing walls. The lateral force-resisting system consists of plywood sheathed shear walls and a plywood roof diaphragm.

The seismic roof upgrade in 2004 added new plywood decking on top of the existing Tectum roof at all areas of the main structure, except those completed in 1998 and 2002. These previous roof upgrades have no existing drawings. However, it can be assumed a similar plywood decking and connections were used through visual observations.

Note: An additional covered play area is present on the northeast side of the 1964 addition, and it is unclear when this covered play area was constructed. It was built with relatively small steel tubes supporting glulam framing and wood decking. There is no apparent lateral force-resisting system and it likely does not tie back into the rest of the structure.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete foundation walls are not adequately doweled into the continuous spread footing.
- Concrete block walls in 1959 and 1964 buildings (especially down the corridors) are not continuous to the roof diaphragm and are a falling hazard.
- Concrete masonry walls that do extend up to the roof diaphragm lack sufficient anchorage for both in-plane and out-of-plane forces.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Cross ties at roof diaphragm will likely need to be strengthened.
- Wood ledgers are in cross-grain bending at some roof connections.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- Straight sheathing (wood decking) at (unknown year) play shelter with no plywood diaphragm.
- 1990 Covered play area does not have an adequate lateral force-resisting system in one direction
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Masonry sculpture wall in front of building is an unreinforced falling hazard.
- Ceilings are not laterally braced.
- Kitchen and mechanical equipment should be braced or anchored down.
- Original or nonannealed overhead glazing can be a hazard.

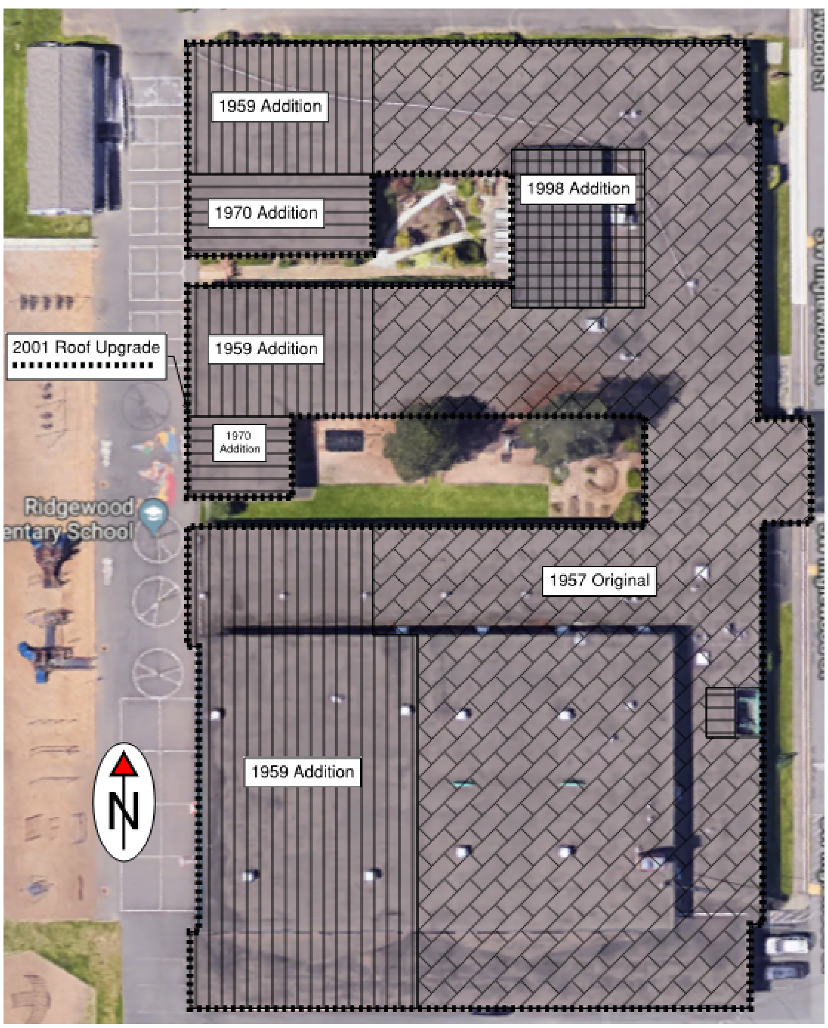
25: Ridgewood Elementary

Building Summary and Building Year Plan

Ridgewood Elementary School was built in 1957, with additions in 1959, 1970, and 1998, with partial seismic strengthening re-roofing projects in both 1998 and 2001.

The original single-story structure, as well as the additions in 1959 and 1970, use interior wood framed walls and interior/exterior single wythe brick walls for the lateral force-resisting system. Many interior wood shear walls (W2) were added in the 1998 lateral upgrade at all of the lower roof areas. The high roof at the gymnasium and cafeteria area are supported by concrete pilasters with unreinforced masonry infill (C3). The 1998 addition also added a few wood framed shear walls with plywood sheathing and brick veneer in the new addition. The roof diaphragm for the entire structure is plywood decking from the 1998 addition/re-roof upgrade and the 2001 roof upgrade.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1957 building consists of multiple classroom wings, an administration area, and a cafeteria/gymnasium with an attached covered play area. The structure is primarily built using concrete frames at the exterior with unreinforced masonry infill, and interior wood and brick walls. The roof framing is mainly wood glulam beams with tongue and groove decking for the diaphragm. The lateral force-resisting system consists of the concrete frames with masonry infill at the gymnasium and interior wood framed walls at the classrooms. The foundations are reinforced concrete shallow foundations and the floor is a reinforced concrete slab-on-grade. Neither the foundations nor floor system are tied into the exterior walls. The lateral force-resisting system at the classrooms consist of wood framed shear walls was not adequate to provide lateral resistance. A new lateral force-resisting system was added in the 1998 addition that provided lateral support at the lower classroom areas.

The 1959 addition added new classrooms to each of the existing wings, a new gymnasium, and expanded the covered play area. This addition uses most of the same elements as the original building, including exterior concrete frames with unreinforced masonry infill walls, interior wood walls, and glulam roof framing with plywood decking. The foundations are again shallow concrete foundations and a slab-on-grade floor. The foundations are tied into the lateral force-resisting system at this addition. The lateral force-resisting system is primarily the exterior masonry walls. However, these walls were inadequate to provide lateral resistance due to the amount of glazing at the classrooms and walls not going all the way to the roof in most areas. A new lateral force-resisting system was added in the 1998 addition.

The 1970 addition added two new classroom areas on the west side of the structure and a new teacher's room on the east side. The classroom areas are attached to the previous addition. However, their construction is similar to the original structure as they use a tongue and groove deck roof diaphragm, and the concrete foundations are not tied into the foundations. This addition also uses exterior masonry walls and glulam roof framing. The lateral force-resisting system was primarily the exterior masonry walls. However, these walls were inadequate to provide lateral resistance due to the amount of glazing and the walls not going all the way to the roof in most areas. A new lateral force-resisting system was added in the 1998 addition.

The addition in 1998 added a new library area in between the two northern most wings, and also made substantial lateral upgrades to the entire structure. The lateral upgrades added modifications to the foundations and roof level. Brick walls were also strengthened and nearly all existing interior wood walls at the classrooms were converted into shear walls by adding plywood sheathing and adding lateral connections to the foundations and roof. The gravity system at the library area is steel tube columns and exterior wood framed walls with brick veneer. The roof framing is made up of glulam beams and wood rafters.

A 2001 re-roofing project added new plywood sheathing onto all areas of the roof that did not get replaced in the 1998 addition. This upgrade also added new connections at the roof that improved in-plane and out-of-place connections.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- All masonry at the 1957 and 1959 areas lack vertical reinforcing per existing drawings and need out-of-plane bracing full height and anchorage at the base. North and south walls of each classroom wing contain partial height masonry walls below the windows. These walls need to be braced for out-of-plane support.
- Gymnasium walls are higher than the allowable per the height-to-thickness ratio and need to be braced.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- The covered play area only has lateral support in one direction.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture unknown but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Fire suppression and other piping are not braced laterally.
- Ceilings are not braced laterally.
- Overhead glazing around exterior of the structure are original and a potential hazard.
- Unreinforced masonry chimney located on top of structure.

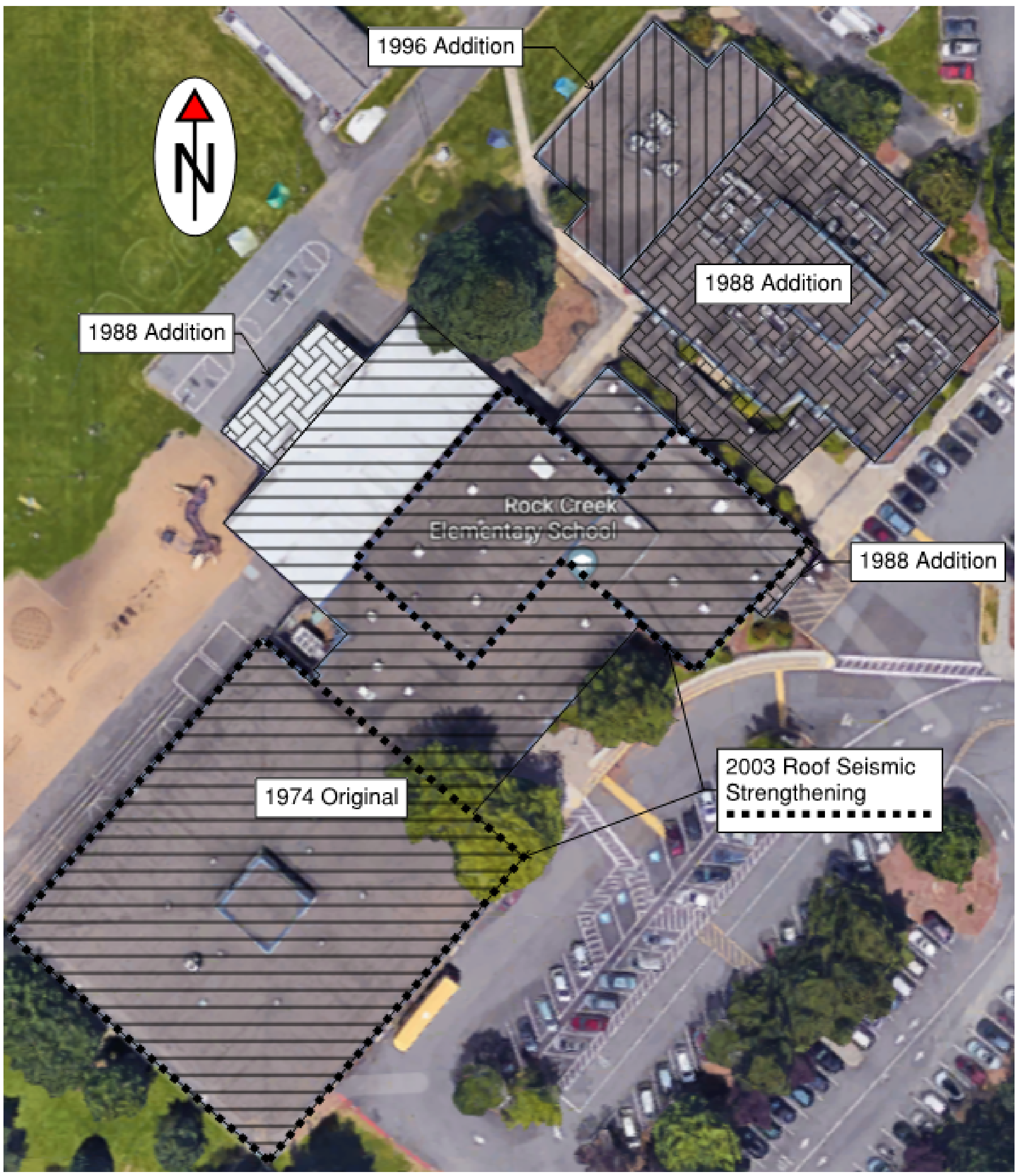
26: Rock Creek Elementary School

Building Summary and Building Year Plan

The Rock Creek Elementary School was built in 1974, with additions in 1988 and 1996, and a seismic roof upgrade in 2003.

The original 1974 structure's lateral force-resisting system consists of reinforced masonry walls (RM1) while the 1988 and 1996 additions use wood shear walls (W2). The roof diaphragm for the majority of the structure is plywood decking, while the covered play area has a tongue and groove wood deck.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The 1974 original building included two separate wings. The first contains classrooms and a library, and the second contains a cafeteria, gymnasium, bathrooms, and administration area. There is also a covered play shelter on the western side. The gravity system consists of reinforced masonry bearing walls, steel tube columns, and wood bearing walls. These elements are supported by reinforced concrete foundations and concrete slab-on-grade systems. The foundations are anchored and connected into the lateral-force resisting system. The lateral force-resisting system is composed of the exterior and interior reinforced masonry shear walls. The roof diaphragm is plywood decking except for over the covered play area where it is tongue and groove decking. The roof framing supporting the deck is composed of wood glulam beams and joists at the majority of the structure except the gymnasium which uses steel joists.

The addition in 1988 added a new classroom wing to the north side of the existing structure, a front entry canopy, and an expansion to the covered play area on the west side. The gravity framing for the classroom area is exterior wood bearing walls and interior steel tube columns. The floor and roof diaphragms are each constructed with plywood decking and have connections back to the lateral force-resisting system. The lateral force-resisting system is made up of exterior plywood shear walls. The foundation system for this addition consists of reinforced concrete shallow foundations with wood posts to support the plywood floor diaphragm. The front entry canopy is an open structure built with wood roof framing, steel columns, and reinforced concrete footings. The covered play area expansion is also an open area with steel tube columns, wood framing, and shallow concrete reinforced foundations.

The most recent addition was added onto the previous 1988 addition and contains new classrooms and commons area. This addition appears to follow the 1988 addition by using plywood floor and roof diaphragms and exterior plywood shear walls. However, there are no existing structural drawings for this addition and these assumptions are made through the architectural drawings and on-site observations.

The 2003 seismic roof upgrade added new connections from the existing plywood roof diaphragm to the masonry shear walls in the center wing of the original 1974 structure and increased the lateral stability of the mechanical units on the roof. None of the existing plywood or tongue and groove decking was replaced.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

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damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

<u>Summary of Seismic Structural Deficiencies</u>

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior masonry walls do not have adequate reinforcement spacing (spacing is 48” o.c.). Further analysis could prove this to be adequate.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- No positive connection from wood posts to foundations at the 1988 and 1996 additions.
- Foundations are not tied together at the 1988 and 1996 additions as there is no concrete slab-on-grade to brace the foundations laterally.
- The pop-up roof at the 1988 addition has long continuous windows on both sides of the long direction and creates a discontinuous diaphragm.
- Wood ledgers are in cross-grain bending at some roof connections in the original building and additions.
- The tongue and roof decking over the covered play area should be strengthened with plywood decking.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

<u>Summary of Seismic Nonstructural Deficiencies</u> (included in cost per square foot above)

- Sprinkler head clearance noncompliant in original 1974 building.
- Some equipment is not properly anchored down to floor/roof diaphragm.
- No seismic joints between additions.

27: Sato Elementary School

Building Summary and Building Year Plan

Sato Elementary School was built in 2017 (designed by DLR Group).

The primary lateral for this structure consists of special steel concentrically braced frames and intermediate precast shear walls.

Building Risk Category IV
Roughly equivalent to ASCE 41-13 Immediate Occupancy Performance Level

Building Description (separated by construction phases)

The 2017 school includes classrooms, cafeteria, gymnasium and covered play area. The structure consists of steel framing, precast concrete wall panels and reinforced masonry walls. This building was designed for seismic risk Category IV.

Seismic Assessment

Due to the recent year of construction, this is a “benchmark building” per ASCE 41-13 and was not evaluated during this assessment for structural deficiencies.

28: Scholls Heights Elementary School

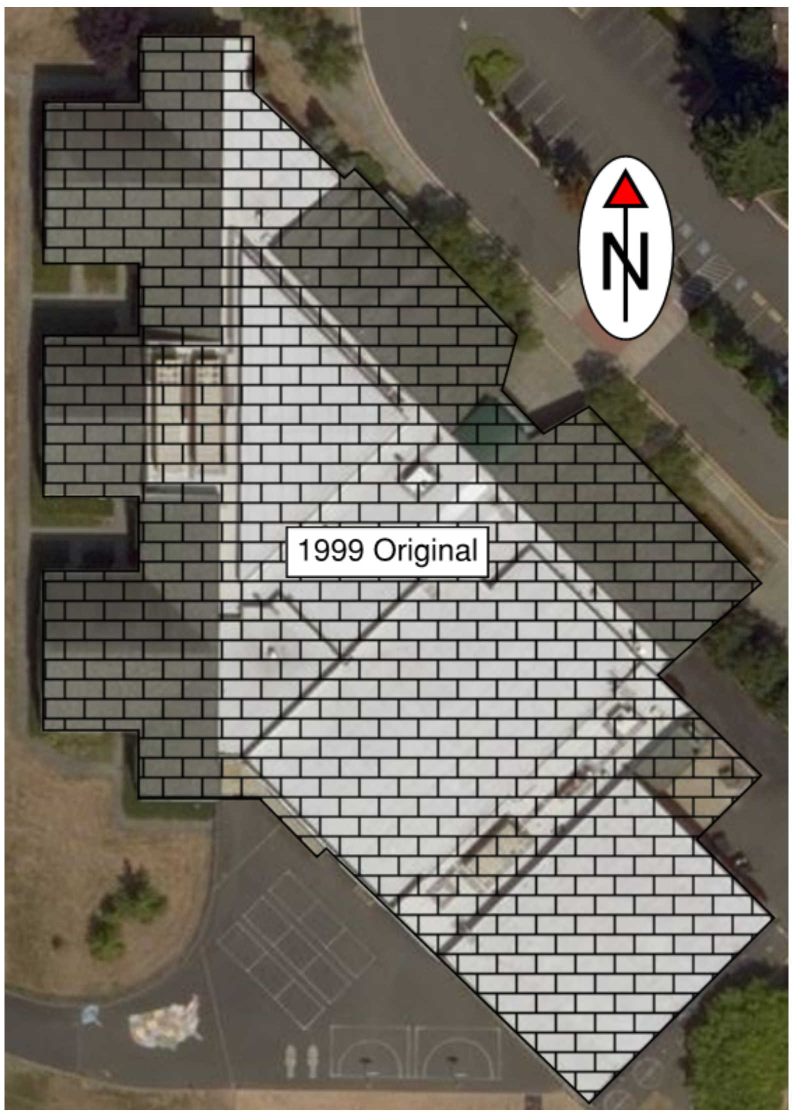
Building Summary and Building Year Plan

Constructed in 1999. The following schools are very similar in plan and in detailing:

- Findley Elementary School
- Nancy Ryles Elementary School
- Scholls Heights Elementary School

This two-story primarily wood framed building (W2) with a flexible plywood roof and second floor diaphragms.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1999 structure includes a classroom wing, administrative areas, a commons/library space, a gymnasium, and a covered outdoor play area. The building is located on a sloped site that drops off to the southwest. The gravity system in typical classroom and administrative areas consists of plywood floor sheathing, wood joists, and wood framed bearing walls. Larger spans including the library/commons are framed with plywood sheathing, glulam beams, and steel columns. The gymnasium is framed with steel open web trusses and steel columns. The roof diaphragm is made of plywood sheathing and has blocked adjacent to shear walls that are parallel to the direction of joist framing. The main lateral force-resisting system consists of plywood or gypsum wallboard bearing and shear walls distributed around the perimeter and throughout the interior of the building. Shear walls are anchored to the foundation with equally spaced anchor bolts along the length of each wall, along with hold-downs. A covered play area at the east side of the structure is supported by a reinforced masonry shear wall (RM1) along the adjoining gymnasium.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

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Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Roof diaphragm contains plywood but is not blocked in all locations. Further analysis is required to determine extent of seismic retrofitting required.
- The roof diaphragm is discontinuous and has several pop-up areas including the roof at the library/commons. This results in a discontinuous lateral load path.
- Roof chords are discontinuous at sloped roof pop-ups.
- There are no continuous collector elements to drag the covered play area roof loads into the main structure roof diaphragm for lateral loads perpendicular to the CMU wall.
- Gypsum wallboard is use for a few shear walls in several locations in the crawl space.

- Glulam girders around perimeter of library pop-up are not continuous and have not been strapped/tied to act as chords.
- The reinforced masonry shear wall is anchored to the roof diaphragm with mechanical anchors that may lack the required strength to support the wall for out-of-plane forces.
- The existing drawings show the vertical reinforcement in the masonry shear wall ending at the bottom of the covered play area beams, and not extending to the top of the wall.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown. Slope failure could be an issue at this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Most tall/narrow contents and equipment which are prone to fall do not appear to be anchored.
- Most MEP did not have adequate seismic bracing.

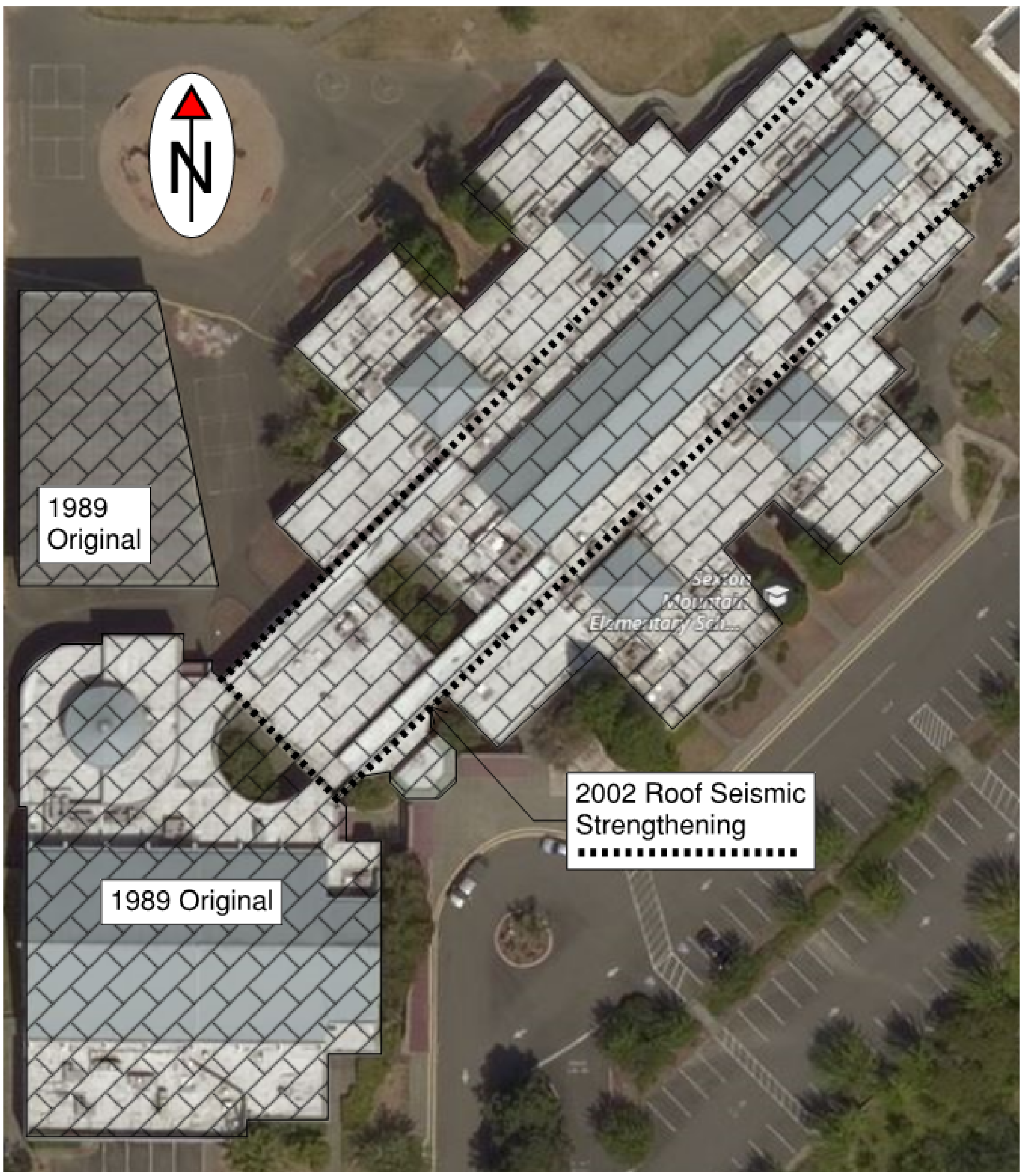
29: Sexton Mountain Elementary School

<u>Building Summary and Building Year Plan</u>

Constructed around 1989, re-roofing in 2002, current on-going re-roofing.

Wood Frame (W2) and Reinforced Masonry Shear Wall (RM1) building with flexible plywood diaphragm roofs in most conditions, and metal deck at a few pop-ups.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The structure consists of both perimeter and interior wood shear walls and some interior reinforced CMU shear walls. Interior shear walls are well distributed throughout the structure. However, plywood diaphragms span more than 40 ft in some cases. Foundations are typical strip and isolated concrete footings with concrete stem walls that extend up to meet either CMU or wood walls at the building perimeter. The floor structure is reinforced concrete slab-on-grade on the middle portion of the building, with direct connection to foundation stem walls. The east and west portions of the building consist of wood framing (with crawl space) supported on isolated footings and perimeter strip footings.

The roof structure is comprised of a combination of commodity lumber, TJI's, TJL open web wood joists, and steel trusses with z-girts. The roof diaphragms are unblocked plywood sheathing where wood framing occurs, while metal deck is utilized at steel truss pop-ups.

The 2002 re-roofing construction included new out-of-plane anchorage of most CMU walls which cantilever past the roof diaphragm but did not in any way appear to augment or improve the seismic performance of the diaphragms themselves.

There was a re-roofing project ongoing during the time of our site visit. After reviewing the drawings, it did not affect the structure's seismic performance.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

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Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Multiple clear-story roof pop-ups do not have identifiable load paths to adjacent roof diaphragms, while clear-story roof pop-ups with shallow diagonal rod bracing appear to act as quasi-diaphragm ties, but further analysis is required. It is possible roof trusses with columns were designed as moment frames for the large roof pop-up. This requires further evaluation/study to confirm this alternate load path.

- Some areas of the roof diaphragm appear to be insufficient based on diaphragm spans, particularly where large roof pop-ups occur. With further analysis, this deficiency could possibly be either reduced or eliminated. Additionally, roof chords appear to be discontinuous.
- Wall segments exceed allowable aspect ratios and may leave other lateral elements undersized at select locations.
- Walls do not appear to have hold-downs.
- Although some anchorage of CMU walls to the roof diaphragm have been added (to eliminate cross-grain bending of the wood ledger), it does not appear that all locations were upgraded.
- Adjacent covered play structure (not attached to the main structure) appears to be laterally supported on only three sides. Additionally, one of those lateral support lines consists of an unbraced partial-height CMU shear wall with braced frame on top.
- Adjacent covered walkway structures (at the front of the building) consist of vertical cantilever CMU piers up from grade with horizontal steel framing cantilevering off their face. The average height of these cantilever CMU piers is around 15 ft.
- It is unclear if blocking has been provided between adjacent z-girts at the metal deck diaphragm locations, in which case a deficiency in load path exists.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

<u>Summary of Seismic Nonstructural Deficiencies</u> (included in cost per square foot above)

- The fire-sprinkler main was braced, but distribution lines are not.
- Most tall/narrow contents and equipment which are prone to fall do not appear to be anchored.

<u>Additional Structural Observations</u>

- Drawings indicate a seismic joint between the classroom wings and the gym portion of the building, however no seismic joint or MEP movement/joint couplers were identified in the field.
- Some parapet bracing (2x members) at the roof exhibited significant rot.

30: Springville (K-8) School

<u>Building Summary and Building Year Plan</u>

Constructed in 2009.

This new two-story structure consists of the following portions: The main building and classroom areas are steel framed using Special Concentrically Braced Frames, SCBF (S2/S2A) in combination with a single Special Masonry Shear Wall, SMWS (RM2), while the gymnasium is constructed using tilt-up concrete walls detailed as Special Reinforced Concrete Shear Walls, SRCS (PC1) with steel joists at the roof level. Roof diaphragms are a combination of 1½ inch and 3 inch metal deck, while floor diaphragms are primarily 3 inch metal deck with 3 inch concrete topping. The structure was designed for seismic design Category D and as a Risk Category III building.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

<u>Building Description (separated by construction phases)</u>

The school, built in 2009, includes three distinct areas: a west classroom wing, a main building (east classrooms, commons, administration and stage), and gymnasium with an adjacent covered play area (designed by others). The gravity system is made up of steel framing at the west classroom wing and main building areas, while tilt-up concrete walls with steel open-web roof joists support gravity loads were used at the gymnasium area. The lateral force-resisting system is designed for seismic and wind loads based on the 2007 OSSC. Foundations consist of reinforced concrete strip footings at bearing/shear walls and column footings at all interior and exterior columns. The floor system consists of a reinforced concrete slab-on-grade with connection back to perimeter foundations and interior wall and braced frame foundations. The metal deck with concrete floor diaphragms, as well as metal roof deck diaphragms at the elevated levels, appear to be designed to provide support to the lateral force-resisting system.

Seismic Assessment

Due to the recent year of construction, this is a "benchmark building" per ASCE 41-13 and was not fully evaluated during this assessment for structural deficiencies. We reviewed the drawings compared to the checklists for this school and noted some potential considerations below.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Lateral force-resisting system designed per 2007 OSSC using 2006 IBC references.
- Geologic site hazards such as Liquefaction, Slope Failure, and Surface Fault Rupture are unknown.
- Some seismically isolated wings only have one line of two or more SCBF frames in a single direction, which technically is a deficiency in the checklists. With further analysis, this potential deficiency will likely prove to be adequate.

Summary of Seismic Nonstructural Deficiencies

- Site visit not performed due to benchmark building.

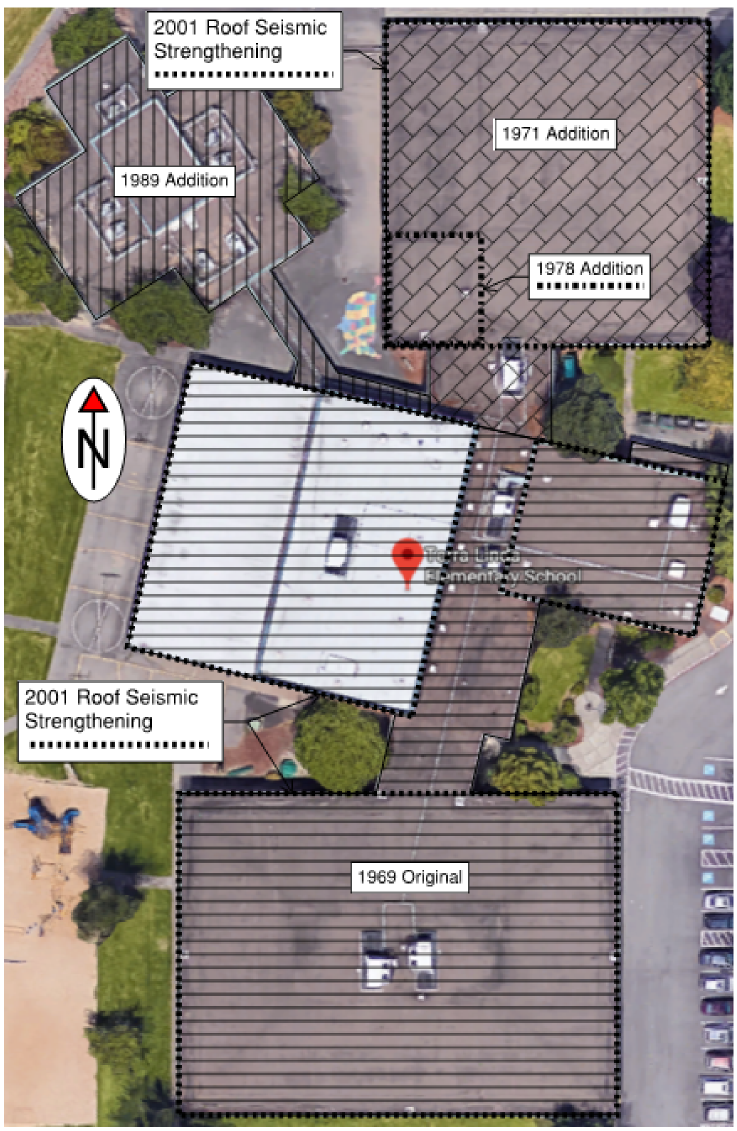
31: Terra Linda Elementary School

Building Summary and Building Year Plan

Terra Linda Elementary School was built in 1969, with additions in 1971, 1978, 1989, and a seismic roofing upgrade in 2001.

The original 1969 building is a single-story reinforced masonry (RM1) structure with wood decking and plywood sheathing overlay as the roof diaphragm. The 1971 addition added more exterior reinforced masonry shear walls. The 1989 addition consisted of a standalone structure that was made of exterior wood shear walls (W2) and plywood diaphragms at both the floor and roof levels.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original building area consists of two wings with classrooms, a gymnasium, a kitchen/cafeteria area, and bathrooms. Structural elements included masonry bearing walls with steel tube columns to support the wood framing at the roof. The floor and foundation systems are reinforced concrete slab-on-grade and shallow foundations. The lateral force-resisting system is reinforced giant brick masonry at the exterior and some interior walls. The roof diaphragm of the original building consists of 2x decking with a plywood overlay. Much of the original roof diaphragm was replaced with new plywood decking in the 2001 roofing upgrade.

The addition in 1971 included new classroom areas, storage, bathrooms, and a covered play area. Construction is similar to the original building as it uses exterior masonry bearing walls, interior wood framing, tube steel columns, and a plywood sheathed roof. Steel wide flange beams and glulam wood beams make up the roof framing. The lateral force-resisting system consists of the exterior masonry walls on the north, south, and east sides. The west side did not have a shear wall of any kind until the 2004 addition. The roof diaphragm is plywood only, rather than the plywood on wood decking as seen in the original structure.

The 1978 addition consists of a new classroom area to the southwest of the 1971 addition at the covered play area. This addition added new masonry shear walls to act as the lateral force-resisting system for this addition. This addition is built up into the existing 1971 covered play area roof which uses a plywood diaphragm.

The addition from 1989 consisted of new classrooms, a couple of small bathrooms, and a covered walkway to the north side of the campus. This addition consists of a reinforced concrete foundation system with steel tube columns supporting wood roof framing. The floor system consists of an elevated wood framing system with a plywood diaphragm supported by relatively small interior concrete posts. Exterior walls are wood framed stud walls with stucco covering. The roof diaphragm is a flexible plywood deck. There is a pop-up roof area in this addition that has multiple small window areas, these windows are only present in the corners on two sides.

The 2001 roofing upgrade consisted of adding new plywood sheathing to all areas of the existing structure except over the gymnasium and office areas. This new sheathing acts as the roof diaphragm and is connected directly to the exterior reinforced masonry walls acting.

Note: The construction of this school is very similar to #7: Chehalem.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete foundation walls are not adequately anchored to foundations at original construction and 1971 addition.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Masonry walls lack sufficient anchorage to all diaphragm elements (most wall connections were strengthened during the 2001 roof strengthening).
- Out-of-plane connections between the lateral elements and roof diaphragm are deficient and will need to be upgraded.
- Roof diaphragm at the office may need strengthening to act as a proper diaphragm.
- Cross ties will likely need strengthening at the roof diaphragm.
- Interior and exterior wood stud walls in both directions will require hold-downs, structural sheathing, and improved connection to the roof diaphragm (in original 1969 and 1971 addition).
- Wood posts in the 1989 addition do not have a positive connection to the foundations.
- Wood ledgers are in cross-grain bending at some roof connections.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Cantilevered columns at covered play area acting as lateral force-resisting system is not sufficient to provide adequate support.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Lights require independent support in the original 1969 building.
- Drop ceilings require bracing across the original 1969, 1971, and 1989 additions.
- No seismic joints between additions.
- Tall kitchen equipment require anchorage in case of seismic event to prevent overturning.
- Original or nonannealed overhead glazing can be a hazard.

32: Vose Elementary School

Building Summary and Building Year Plan

Vose Elementary School was built in 2017 (designed by DLR Group).

The primary lateral force-resisting system for this structure consists of special steel concentrically braced frames and intermediate precast shear walls.

Building Risk Category IV
Roughly equivalent to ASCE 41-13 Immediate Occupancy Performance Level

Building Description (separated by construction phases)

The new elementary school replaced the original school built in 1960. This new building includes classrooms, cafeteria, gymnasium and covered play area. The structure consists of steel framing, precast concrete wall panels and reinforced masonry walls. This building was designed for seismic risk Category IV.

Seismic Assessment

Due to the recent year of construction, this is a “benchmark building” per ASCE 41-13 and was not evaluated during this assessment for structural deficiencies.

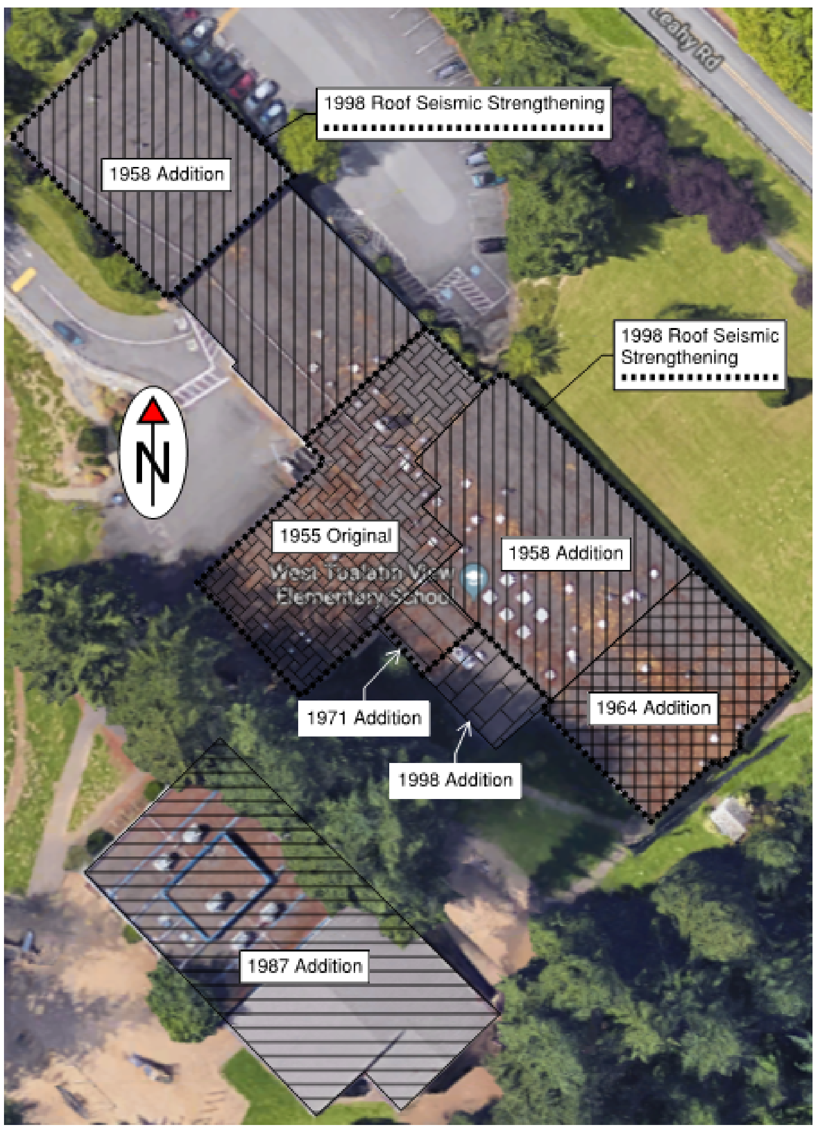
33: West Tualatin View Elementary School

Building Summary and Building Year Plan

West Tualatin View Elementary School was built in 1955, with additions in 1958, 1964, 1971, 1987, and a lateral upgrade/addition in 1998.

The original 1955 building uses a small central core of reinforced masonry (RM1) to provide lateral support, with subsequent additions using exterior and interior wood framed shear walls (W2). The roof system uses a plywood diaphragm to tie into the lateral force-resisting system. The standalone structure built in 1987 also uses plywood shear walls and plywood roof and floor diaphragms.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1955 building includes a basement and main floor level. There are a relatively large number of classrooms on the main level and a large playroom area in the basement, as well as a crawl space and boiler room. The gravity elements for the original structure include primarily wood bearing walls with a small central core of masonry walls. These masonry walls are the primary lateral force-resisting system for the structure. Wood shear walls were later added during the 1998 addition/lateral upgrade. The floor diaphragm has plywood sheathing, while the roof diaphragm has straight wood sheathing.

The 1958 addition enlarged the original building both to the northwest and southeast. On the northwest side of the 1955 building a gymnasium, classrooms, and a covered drive between buildings was added. On the southeast side of the 1955 building, a large area with classrooms and bathrooms was added. The southeast area of this addition uses wood bearing and shear walls at the exterior and interior for the gravity and the lateral force-resisting systems. The gymnasium to the northwest contains concrete pilasters with unreinforced brick masonry infill. This brick infill is one wythe thick and has no vertical reinforcement per the existing drawings. The foundation system for the gymnasium area is a concrete slab-on-grade, while all the classroom areas are shallow foundations with wood posts supporting a plywood floor diaphragm. The roof system for both areas of this addition contains tongue and groove wood decking for the roof diaphragm.

The addition in 1964 added four new classrooms to the south end of the 1958 southeast addition. This addition is supported by wood framed bearing and shear walls for both gravity and lateral support. The floor system is supported by concrete shallow foundations and wood posts and contains a plywood floor diaphragm. The roof diaphragm is tongue and groove decking across the entire addition.

The 1971 addition added a new library area on the southwest corner of the 1955 and 1958 additions. This addition contains a daylight basement level storage room under the main floor level library addition. The wood framed addition contains new exterior masonry shear walls. The addition is supported by a shallow foundation system with a concrete slab-on-grade in the basement. The main floor contains plywood sheathing, while the roof diaphragm contains straight wood decking.

The 1987 addition is a standalone structure to the southwest of the primary building. This structure consists of multiple classrooms and a covered play area. The existing structural drawings for this addition are unreadable. Therefore, based off of the architectural drawings, the lateral force-resisting system consists of exterior wood framed shear walls with plywood sheathing and an exterior reinforced masonry wall between the classroom and covered play areas. The floor system for the classroom areas are concrete shallow foundations supporting wood members with a plywood floor diaphragm. The covered play area has asphalt paving above shallow foundations supporting steel columns. These steel columns are also used as a moment frame system acting as part of the lateral force-resisting system for this addition.

The 1998 addition consisted of a new small classroom area between the 1971 and 1958 additions. This addition added new wood framed shear walls with plywood sheathing on the exterior. The roof diaphragm consists of OSB sheathing supported on wood framing. The floor system is constructed of wood framing with plywood sheathing on top wood posts supported by shallow concrete foundations. Included with this addition were various lateral modifications to the previous additions. These lateral modifications consisted of additional anchorage at wood shear walls, new wood shear walls (exact locations unknown), and adding a new footing wall within the crawl space in the 1958 addition.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Wood decking acts as straight sheathing and plywood would need to be added to act as proper diaphragm.
- Cross ties at roof diaphragm will likely need to be strengthened.
- Unreinforced masonry shear walls lack sufficient reinforcement for in-plane and out-of-plane forces and lack anchorage.
- Additional shear walls are likely required to meet the performance criteria of current codes.
- Wood ledgers are in cross-grain bending at some roof connections and need strengthening.
- Ties between foundation elements at play shelter do not exist. Asphalt paving possibly restrains footings.
- Many shear walls to roof diaphragm connections do not provide sufficient in-plane support. Some were strengthened in 1998.
- Interior wood posts supporting the floor in the 1959 and 1978 additions are not positively connected to the footing or floor framing.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

<u>Summary of Seismic Nonstructural Deficiencies</u> (included in cost per square foot above)

- Sprinklers do not have proper clearance to prevent seismic shear cut off.
- Lights are not independently braced laterally.
- Fire suppression and other piping needs to be braced laterally.
- A new roof is likely needed per visual observations.
- Original unreinforced brick chimney present at center of structure.
- Original or nonannealed overhead glazing can be a hazard.
- No seismic joints between additions.

34: William Walker Elementary School

Building Summary and Building Year Plan

William Walker Elementary School was built in 2018 (designed by DLR Group).

The primary lateral for this structure consists of special steel concentrically braced frames and intermediate precast shear walls.

Building Risk Category IV
Roughly equivalent to ASCE 41-13 Immediate Occupancy Performance Level

Building Description (separated by construction phases)

The new elementary school replaced the original school built in 1960. The new school includes classrooms, a cafeteria, gymnasium, and covered play area. The structure consists of steel framing, precast concrete wall panels, and reinforced masonry walls. This building was designed for seismic risk Category IV.

Seismic Assessment

Due to the recent year of construction, this is a “benchmark building” per ASCE 41-13 and was not evaluated during this assessment for structural deficiencies.

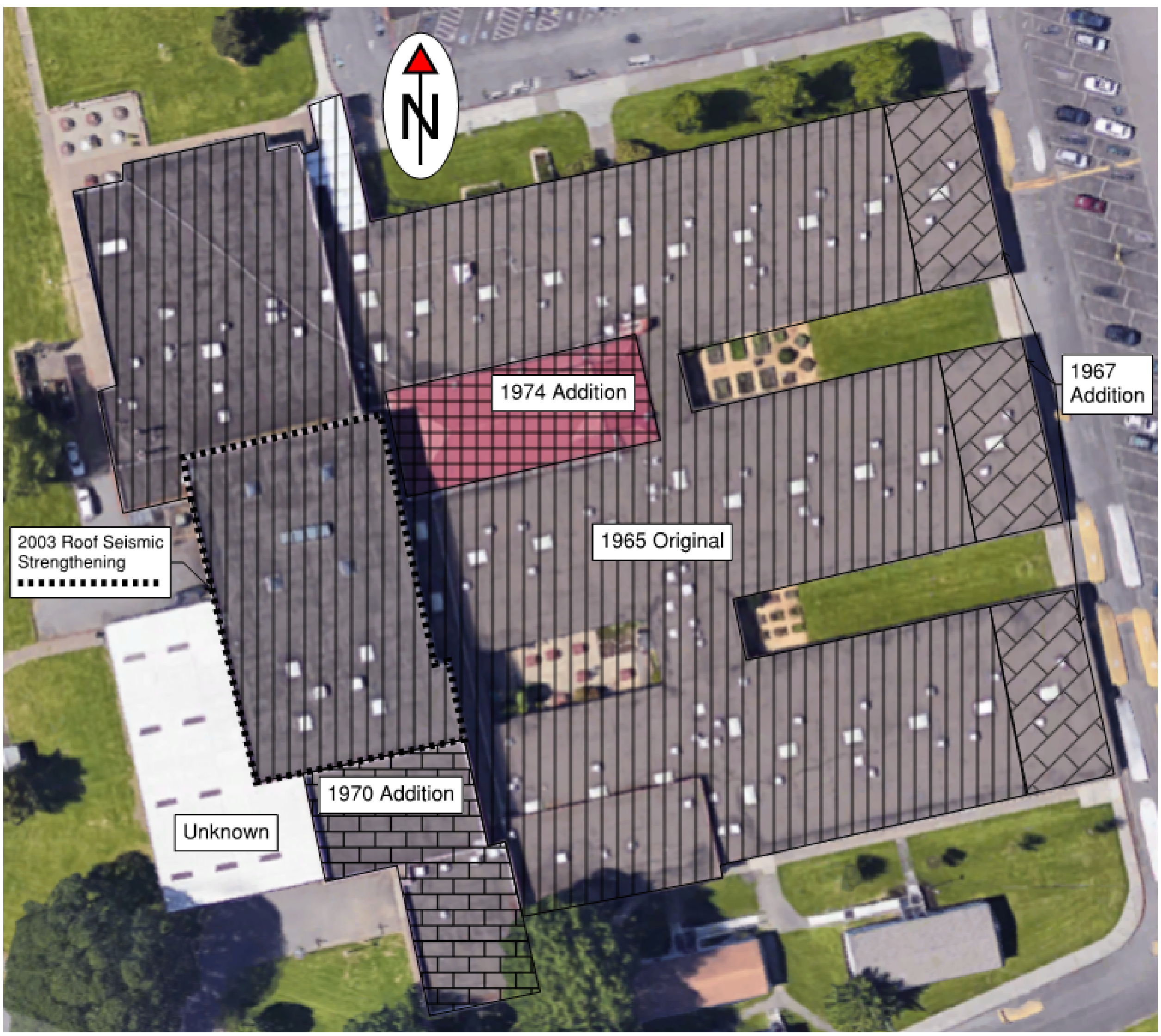
35: Cedar Park Middle School

<u>Building Summary and Building Year Plan</u>

The Cedar Park Middle School was constructed in 1965, with additions in 1967, 1970, 1974, a covered play area (unknown construction date), and a seismic upgrade to the roof in 2003.

Tilt-up concrete (PC1) building with a flexible plywood diaphragm roof at classrooms and Tectum roof at gym and shop/wrestling room additions. The majority of the roofs are cambered glulam timber beams and steel roof trusses at the gymnasium. Gravity support provided by interior wood bearing walls, perimeter built-up steel columns, and concrete walls at the gymnasium.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1965 construction and later additions are well documented and consistent using the same building scheme between the four middle schools listed:

- Cedar Park Middle
- Meadow Park Middle
- Highland Park Middle
- Whitford Middle

The lateral structure consists of perimeter tilt-up concrete walls spanning between steel columns and concrete pilasters. Interior wood bearing walls are not explicitly sheathed for any lateral performance. Foundations are typical concrete strip footings with concrete stem walls that extend up to meet either concrete or wood stud walls. Floor structure is reinforced concrete slab-on-grade with no direct connection to any foundation or stem walls. The diaphragm is connected to shear walls for in-plane load transfer but lacks adequate connections for out-of-plane loading. The classroom wings contain plywood diaphragms while the gymnasium and 1970 addition contain Tectum sheathing.

Additional classrooms constructed in 1967 used existing structural elements to convert exterior covered space to additional classrooms.

The 1970 addition includes a metal shop and wrestling/activity room. Perimeter walls are constructed of tilt-up concrete, similar to the initial 1962 construction. Long span steel trusses supporting Tectum sheathing comprise the roof structure of both areas.

The 1974 addition included a partial remodel of a classroom wing and enclosure of an existing exterior courtyard. Pitched glulam beams span existing bearing walls and are stabilized by steel tie-rods. Positive connections exist between structural members, but not directly to the diaphragm. The diaphragm is not fully blocked, and the structure lacks a complete load path between the beams and the diaphragm for in-plane and out-of-plane loading.

A relatively small amount of roof strengthening was conducted in 2003. Out-of-plane strengthening was performed for the gymnasium perimeter concrete walls at the low roof level.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit

damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete walls are not adequately anchored to diaphragm for out-of-plane forces (and potentially in-plane in some locations), which is typical throughout the building except at low roof around gymnasium where strengthened in 2003.
- Precast wall panels lack a positive connection to the foundation capable of developing strength of the wall.
- Classroom wings exterior walls contain “ribbon windows” and do not have any dedicated shear walls. Provide interior wood shear walls to address diaphragm span deficiency.
- Classroom wing roof beams likely require strengthened connection to columns.
- Tectum roof at gymnasium, shop, and wrestling room not capable of transferring lateral forces.
- A potential deficiency exists between diaphragms at original construction and courtyard infill for both in-plane and out-of-plane load transfer.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Cafeteria roof diaphragm requires strengthening as the span exceeds the capacity of an unblocked plywood diaphragm.
- Steel framed cantilevered column entry canopy needs to be strengthened.
- Covered play area does not appear to contain a lateral force-resisting system and should be tied into the main building.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies

- Tall and narrow kitchen appliances.
- The drop ceilings in the administration area was unbraced.
- There are unbraced CMU Partitions in the locker rooms and in the 1970 addition.

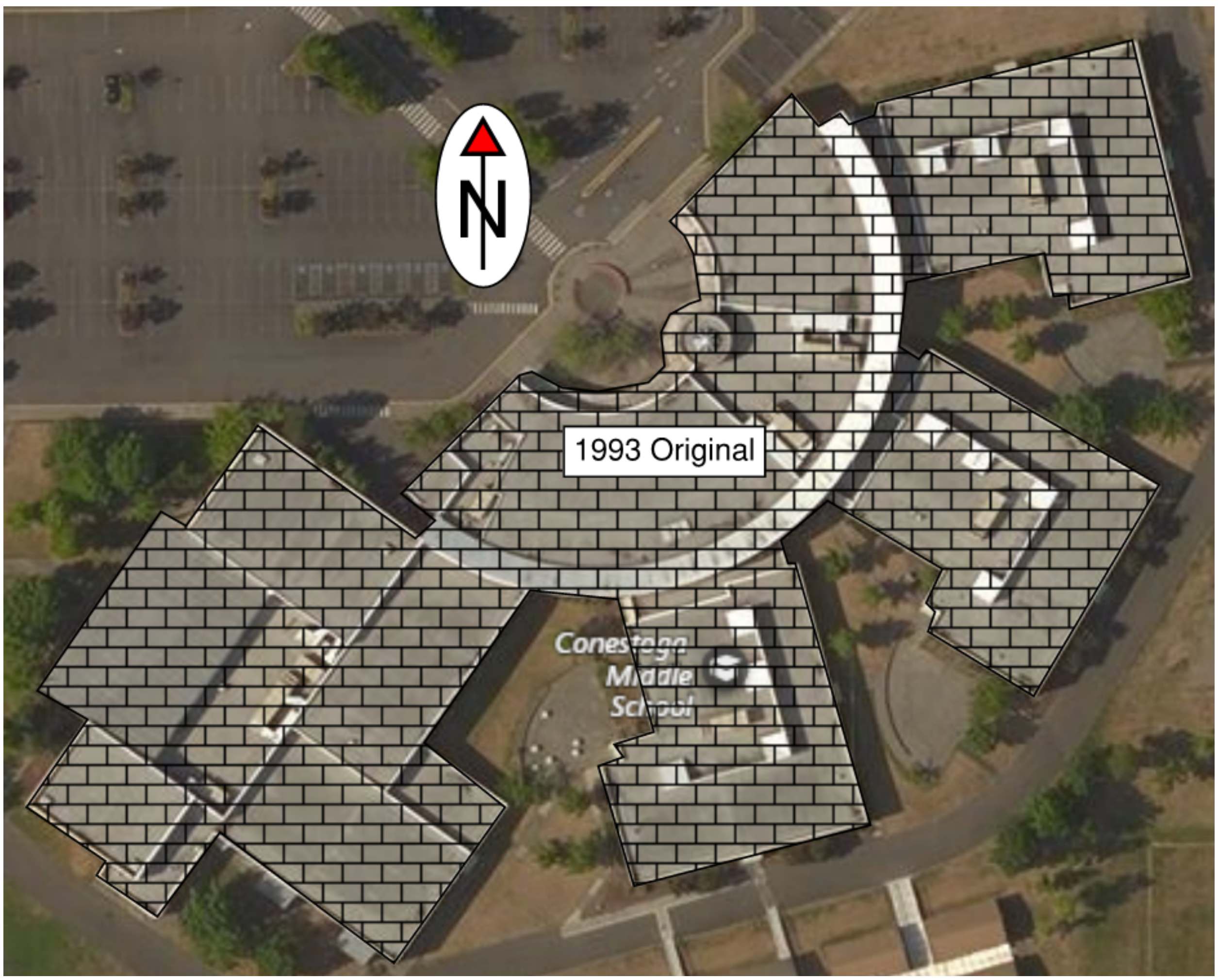
36: Conestoga Middle School

Building Summary and Building Year Plan

The Conestoga Middle School was constructed in 1993 with a re-roofing in 2015 (no seismic performance modifications).

The lateral system contains wood frame shear walls (W2) and reinforced masonry shear walls (RM1) with flexible plywood diaphragms.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1993 building is well documented and clear. The structure consists of perimeter wood perforated shear walls and reinforced CMU shear walls around the physical education wing (western-most wing) and main core. Interior shear walls are well distributed throughout the structure with most plywood diaphragms spanning less than 30 feet. Foundations are typical strip and isolated concrete footings with concrete stem walls that extend up to meet either CMU or wood walls at the building perimeter. The floor structure is a reinforced concrete slab-on-grade with a direct connection to perimeter foundations and stem walls. The roof structure is comprised of TJI and open web wood and steel joists with details for seismic ties where joists are not continuous. The roof diaphragms contain plywood sheathing and are blocked in areas of high shear. Three-inch seismic joints are provided between the central core and the four wings.

The 2015 re-roofing construction included several details for updated roofing insulation and flashing but did not modify the seismic performance of the diaphragms.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Some areas of the roof diaphragm may be insufficient based on diaphragm span. With further analysis, this potential deficiency may prove to be adequate. The plywood diaphragm did not appear to be blocked.
- Wall segments exceed allowable aspect ratios and may leave other lateral elements undersized. With further analysis, this potential deficiency may prove to be adequate.

Summary of Seismic Nonstructural Deficiencies

- There are tall unbraced storage racks in various storage rooms.
- It was unclear if the telescoping bleachers were properly anchored. It was assumed that they were not compliant.

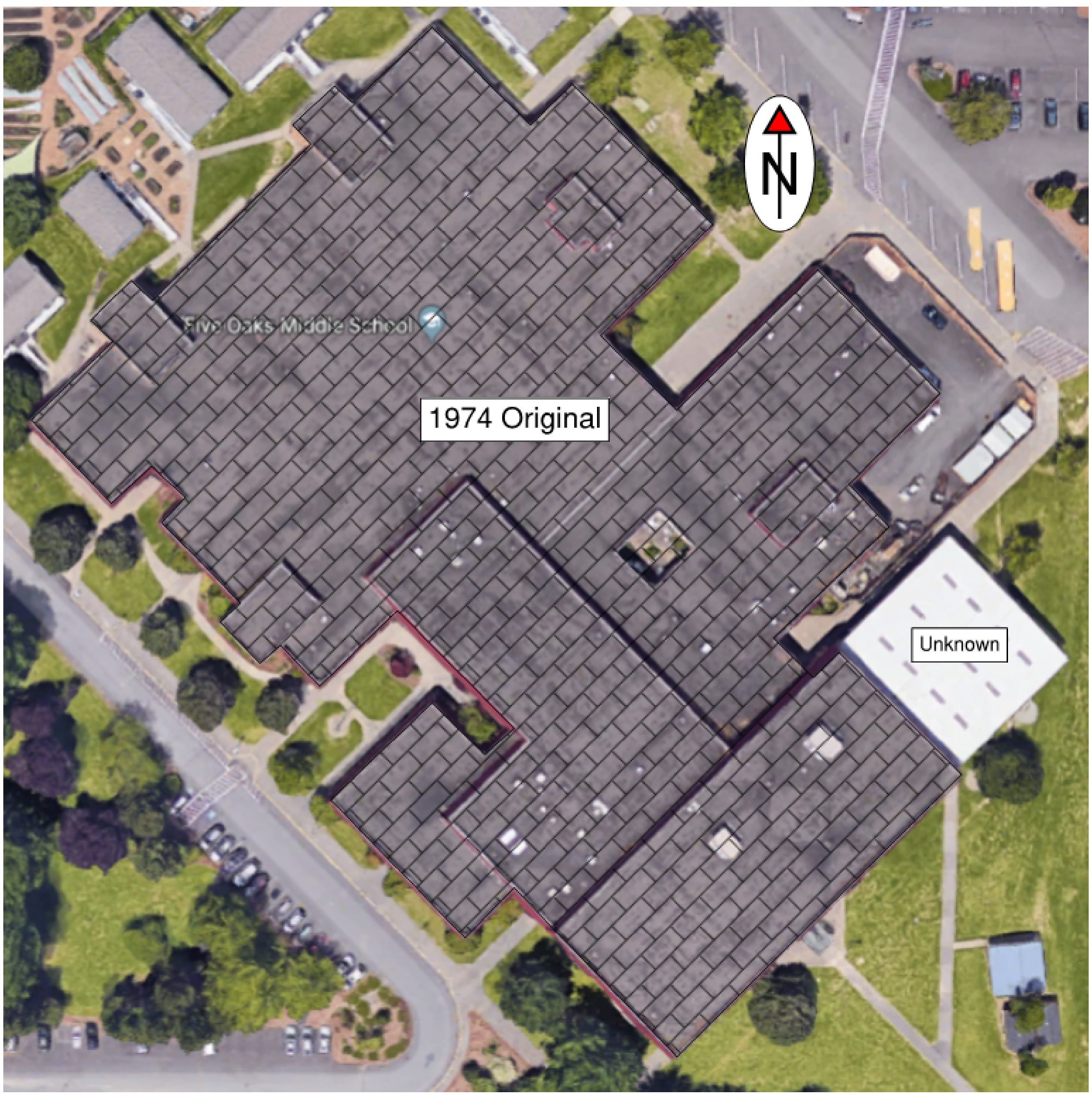
37: Five Oaks Middle School

Building Summary and Building Year Plan

The Five Oaks Middle School was constructed in 1974 with a covered play area added at a later date (unknown year). The school was undergoing multiple renovations during our site visit in 2018. They were also starting excavation/foundations on an addition to the northwest of the school.

The lateral force-resisting system for the building contains both reinforced masonry shear walls (RM1) and tilt-up concrete shear walls (PC1). The flexible roof diaphragm is a bare metal roof deck.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1974 building has a combination of reinforced brick masonry shear walls, reinforced CMU shear walls, precast concrete shear walls, and wood bearing walls. Connections between the concrete shear wall panels and pilasters are made through dowels cast into the wall panels at a typical spacing. Details show conditions where tilt-up concrete panels are not directly attached to foundations, but reinforced brick/CMU walls are doweled into strip footings and stem walls. The ground floor is constructed of a concrete slab-on-grade that is not directly connected to any foundation or wall elements. Gravity support for the roof is provided by the bearing walls along the perimeter and steel HSS posts on the interior. The roof is built from a combination of open web steel joists and wide flange beams which support bare metal decking.

Exterior shear walls are predominantly constructed of reinforced brick and reinforced CMU. The connection between the metal deck diaphragm and the shear walls are inconsistent. There are a number of shear walls that do not continue to the diaphragm, including locations where metal stud walls stack on top of CMU walls. Reinforced CMU walls that intersect concrete wall panels are positively connected using anchors at typical spacing. All CMU walls are directly connected to foundations.

The gymnasium built during the original 1974 construction is seismically separated from the rest of the building using a 1 inch joint. Construction drawings show precast concrete panels at all exterior walls connected through cast-in-place concrete pilasters. The roof structure is comprised of open web steel joists with diagonal channel bridging at the top flange to brace the joists and a metal deck diaphragm. A 1 inch expansion joint is shown between diaphragm elements and perimeter walls. The seismic joint is not detailed properly at the roof level.

The covered play area is a steel “Butler Building” frame and appeared to have moment frames in both directions.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior shear walls are not adequately anchored to diaphragms for both in-plane and out-of-plane forces.
- Precast wall panels lack a positive connection to the foundation capable of developing strength of the wall.
- Shear wall lines lack continuous collectors at the roof level which may lead to a potential deficiency in the diaphragm.
- No connection is present between slabs and foundation elements.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- A potential deficiency exists at the gymnasium pilasters for out-of-plane loading.
- Seismic joint detailing and size likely insufficient between main building and gymnasium.
- Reinforced brick site walls could be a falling hazard and should be analyzed further.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Fire suppression piping is not braced.
- Sprinkler head clearance is not in compliance.
- Ceilings are not braced.
- Lights are not independently supported at drop ceilings.
- There are unbraced masonry walls (in storage rooms, etc.)
- There are unbraced partitions.

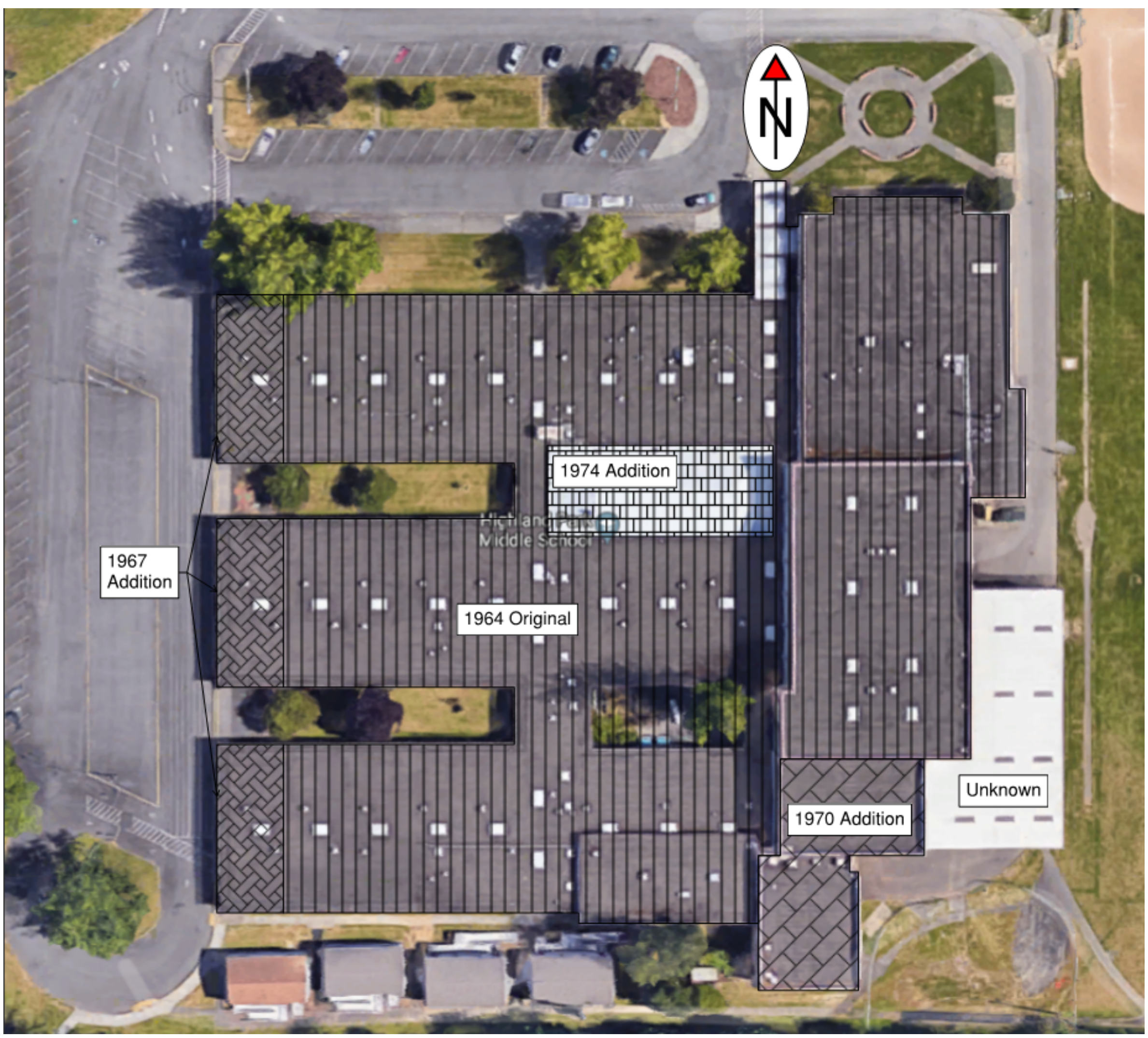
38: Highland Park Middle School

<u>Building Summary and Building Year Plan</u>

The Highland Park Middle School was constructed in 1964, with additions in 1967, 1970, and 1974. The covered play area has an unknown construction date.

The lateral force-resisting system consists of tilt-up concrete shear walls (PC1) with flexible plywood roof diaphragms at classrooms and Tectum at the gym and shop/wrestling room additions. The roof is primarily constructed of cambered glulam timber beams throughout and steel roof trusses at the gymnasium. Gravity support provided by interior wood bearing walls, perimeter built-up steel columns, and concrete walls at the gymnasium. This building has not been seismically strengthened.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1964 construction and later additions are well documented and consistently use the same building scheme between the four middle schools listed:

- Cedar Park Middle
- Meadow Park Middle
- Highland Park Middle
- Whitford Middle

The lateral structure consists of perimeter tilt-up concrete walls spanning between steel columns and concrete pilasters. Interior wood bearing walls are not explicitly sheathed for any lateral performance. Foundations are typical concrete strip footings with concrete stem walls that extend up to meet either concrete or wood stud walls. Floor structure is reinforced concrete slab-on-grade with no direct connection to any foundation or stem walls. The diaphragm is typically connected to shear walls for in-plane load transfer but lacks adequate connections for out-of-plane loading. The classroom wings contain plywood diaphragms while the gymnasium and 1970 addition contain Tectum sheathing.

Additional classrooms construction in 1967 used original structural elements to convert an exterior covered space to additional classrooms.

The 1970 addition includes a metal shop and wrestling/activity room. Perimeter walls are constructed of tilt-up concrete, similar to the initial 1964 construction. Long span steel trusses comprise the roof structure of both areas and are sheathed with Tectum.

The 1974 addition included a partial remodel of a classroom wing and enclosure of an existing exterior courtyard. Pitched glulam beams span the once courtyard and are stabilized by steel tie-rods. Positive connection is made between added and existing structural members, other than the diaphragm. The diaphragm is not fully blocked, and the structure lacks a complete load path between the beams and the diaphragm for in-plane and out-of-plane loading.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete walls are not adequately anchored to the diaphragm for out-of-plane forces (and potentially in-plane in some locations) which is typical throughout the building.
- Precast wall panels lack a positive connection to the foundation capable of developing strength of the wall.
- Classroom wings exterior walls contain “ribbon windows” and do not have any dedicated shear walls. Provide interior wood shear walls to address the diaphragm span deficiency.
- Classroom wing roof beams likely require strengthened connection to columns.
- Tectum roof at the gymnasium, shop, and wrestling room not capable of transferring the lateral forces.
- A potential deficiency exists between diaphragms at the original construction and 1974 courtyard infill for both in-plane and out-of-plane load transfer.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Cafeteria roof diaphragm requires strengthening as the span exceeds the capacity of an unblocked plywood diaphragm.
- Potential deficiency exists at the large concrete entry canopy that will likely require foundation and column strengthening.
- Covered play area does not appear to contain a lateral force-resisting system and should be tied into the main building.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies

- Tall and narrow kitchen appliances.
- The drop ceilings in the administration area was unbraced.
- There are unbraced CMU Partitions in the locker rooms and in the 1970 addition.

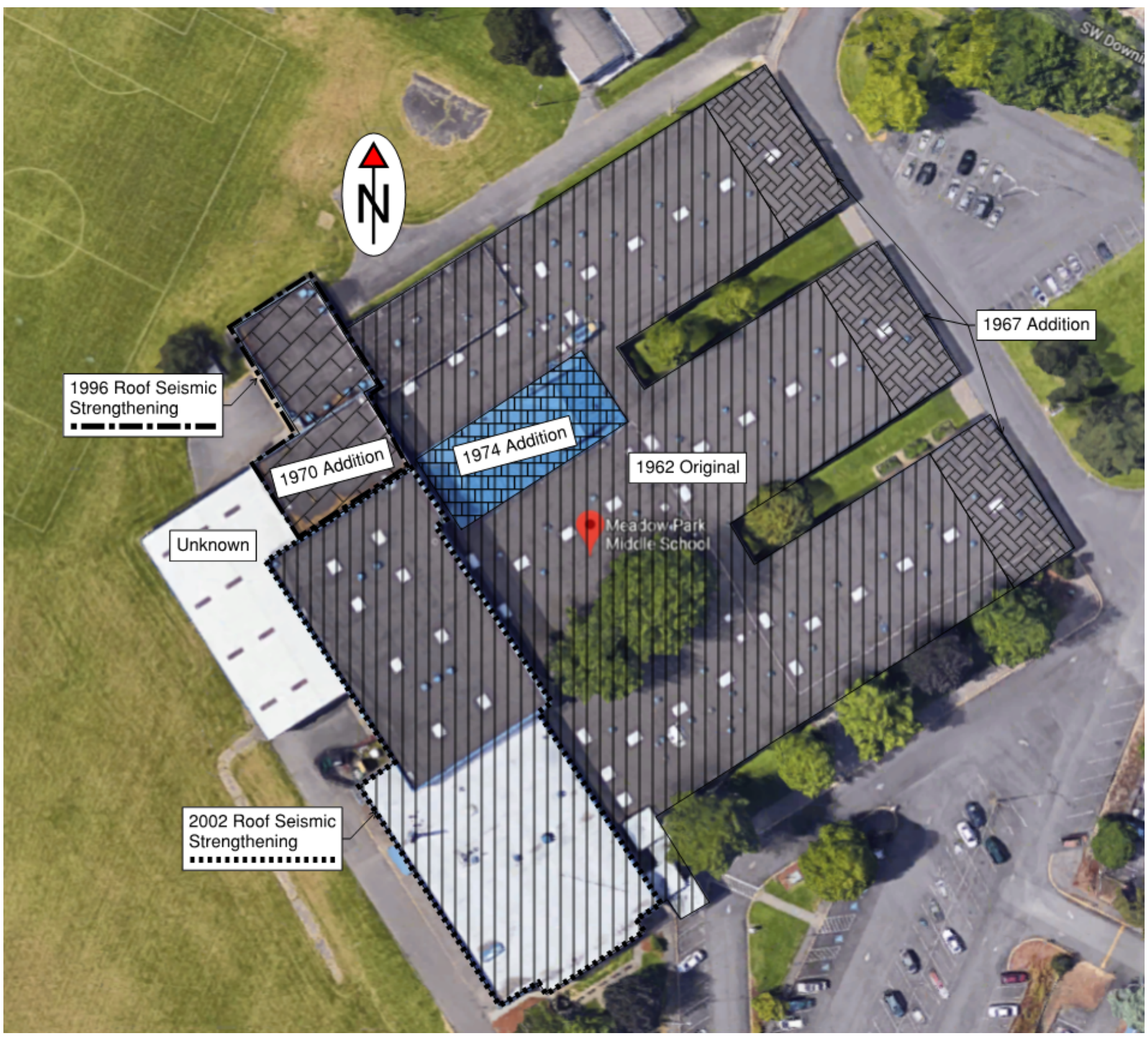
39: Meadow Park Middle School

<u>Building Summary and Building Year Plan</u>

The Meadow Park Middle School was constructed in 1962, with additions in 1967, 1970, 1974, a covered play area (with an unknown construction year), and partial seismic roof strengthening in 1996 and 2002.

The lateral force-resisting system consists of tilt-up concrete shear walls (PC1) with flexible plywood diaphragm roofs at classrooms and a Tectum roof at the gym and shop/wrestling room additions. The roof is primarily constructed of cambered glulam timber beams throughout and steel roof trusses at the gymnasium. Gravity support provided by interior wood bearing walls, perimeter built-up steel columns, and concrete walls at the gymnasium.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



ELEMENTARY SCHOOLS | MIDDLE SCHOOLS | HIGH SCHOOLS | OPTION SCHOOLS | SUPPORT FACILITIES

Building Description (separated by construction phases)

The original 1962 construction and later additions are well documented and consistent using the same building scheme between the four middle schools listed:

- Cedar Park Middle
- Meadow Park Middle
- Highland Park Middle
- Whitford Middle

The lateral structure consists of perimeter tilt-up concrete walls spanning between steel columns and concrete pilasters. Interior wood bearing walls are not explicitly sheathed for any lateral performance. Foundations are typical concrete strip footings with concrete stem walls that extend up to meet either concrete or wood stud walls. Floor structure is reinforced concrete slab-on-grade with no direct connection to any foundation or stem walls. The diaphragm is connected to shear walls for in-plane load transfer, but lacks adequate connections for out of plane loading. The classroom wings contain plywood diaphragms, while the gymnasium and 1970 addition contain Tectum sheathing.

Additional classrooms constructed 1967 used existing structural elements to convert exterior covered space to additional classrooms.

The 1970 addition includes a metal shop and wrestling/activity room. Perimeter walls are constructed of tilt-up concrete, similar to the initial 1962 construction. Long span steel trusses comprise the roof structure of both areas which are sheathed with Tectum roofing.

The 1974 addition included a partial remodel of a classroom wing and enclosure of an existing exterior courtyard. Pitched glulam beams span the once courtyard and are stabilized by steel tie-rods. Positive connection is made between added and existing structural members other than the diaphragm. The diaphragm is not fully blocked and the structure lacks a complete load path between the beams and the diaphragm for in-plane and out-of-plane loading.

In 1996, the Tectum roofs at the shop and wrestling room were strengthened using an overlaid plywood diaphragm, and connections to (E) concrete walls were strengthened. In 2002, the Tectum roofs at the gymnasium were strengthened using an overlaid plywood diaphragm, and out-of-plane connections to the concrete perimeter walls were strengthened (except at the classroom wings). Tension ties were fastened to framing members and anchored to concrete walls to address out-of-plane wall deficiencies around the perimeter of the cafeteria wing.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete walls are not adequately anchored to diaphragm for out-of-plane forces (and potentially in-plane in some locations), which is typical at the classroom wings. The rest of the building was strengthened in 1996 and 2002. The 1996 and 2002 upgrades might not meet current strengthening requirements but have been considered retrofitted for this district planning study.
- Precast wall panels lack a positive connection to the foundation capable of developing strength of the wall.
- Classroom wings exterior walls contain “ribbon windows” and do not have any dedicated shear walls. Provide interior wood shear walls to address diaphragm span deficiency.
- Classroom wing roof beams likely require strengthened connection to columns.
- A potential deficiency exists between diaphragms at original construction and courtyard infill for both in-plane and out-of-plane load transfer.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Cafeteria roof diaphragm requires strengthening as the span exceeds the capacity of an unblocked plywood diaphragm.
- The large concrete entry canopies require foundation and column strengthening or a full replacement. The individual inverted concrete shells pose a significant risk of failure right at the entry.
- Covered play area does not appear to contain a lateral force-resisting system and should be tied into the main building.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies

- Tall and narrow kitchen appliances.
- The drop ceilings in the administration area was unbraced.
- There are unbraced CMU Partitions in the locker rooms and in the 1970 addition.

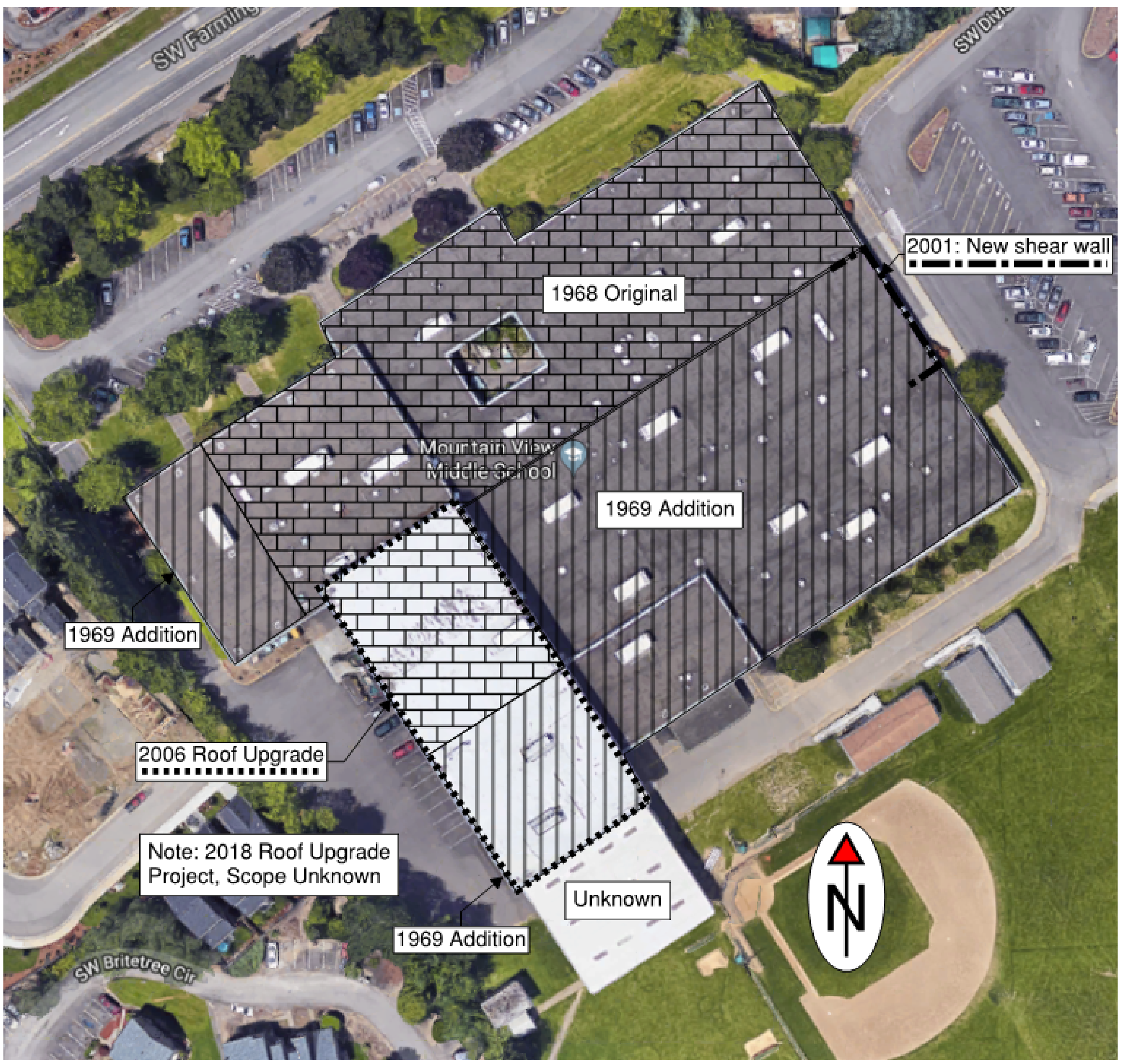
40: Mountain View Middle School

Building Summary and Building Year Plan

The Mountain View Middle School was constructed in 1968, with an addition in 1969, and a 2001 infill. Re-roofing was performed in 2006 that included some seismic upgrades.

The lateral force-resisting system consists of wood frame shear walls (W2), precast shear walls (PC1) and reinforced masonry shear walls (RM1) with flexible metal deck diaphragms, except in the gymnasium which contains Tectum roof sheathing. There was a re-roofing project occurring during our assessment in 2018, but no drawings were available. It appeared that seismic work was not a part of the scope.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1968 building and the 1969 addition is a single-story structure with multiple classrooms, offices, and a gymnasium. The original drawings are difficult to read. However, through visual observation it can be seen that this building was constructed of a metal deck diaphragm, concrete tilt-up panel shear walls, wood shear walls, and masonry shear walls. The metal roof is supported by steel open web trusses which bear on the concrete and masonry shear walls. It can be seen in the original building documents that the foundation consists of concrete strip footing and a concrete slab-on-grade. It is unclear in the building documents and through visual observation how the shear walls tie into the foundations. It is assumed, based on the age of construction, that the shear walls and the diaphragm are not properly tied together.

In 2001, an infill was constructed under the original roof structure which consisted of a masonry shear wall, a new slab-on-grade, strip footings, and detailing for ties into the existing roof structure.

In 2006 the damaged roof overhang around the gym was repaired. This repair included upgrades to the out-of-plane support for the concrete tilt-up walls at the roof. This upgrade was only performed for the exterior walls and did not occur along the interior walls.

The covered play area is a steel framed "Butler Building" with moment frames in both directions and a metal deck diaphragm.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- The roof diaphragm is constructed of Tectum decking in the gymnasium and needs to be replaced/strengthened.

- Some shear walls in the gymnasium appear to be unsupported for out-of-plane loading at the roof diaphragm.
- The shear walls in the gymnasium do not meet the slenderness requirement and likely require out-of-plane bracing.
- Steel reinforcement ratio of the CMU walls do not meet the minimum requirements and likely need strengthening. There is no horizontal reinforcement called out in the plans.
- The concrete tilt-up walls are not adequately tied into the foundation. There is also nothing tying the concrete slab-on-grade to the strip footings.
- The diaphragm is not connected to the CMU shear walls in some locations for both in-plane and out-of-plane support.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Drop ceilings are not braced.
- Lighting in the drop ceiling system are not independently supported or braced at some locations.
- Fire suppression piping is not braced.
- Fire suppression piping does not have proper clearances in the drop ceiling.
- Wood partitions are supported by the bottom of trusses for out of plane loading. No bracing for these walls were observed.
- There are URM partitions in the locker rooms. These partitions are assumed to be unsupported at the roof structure.

41: Timberland Middle School

Building Summary and Building Year Plan

Timberland Middle School was built in 2017 (designed by KPFF).

The primary lateral for this structure consists of steel buckling restrained braced frames and special reinforced precast concrete shear walls.

Building Risk Category IV
Roughly equivalent to ASCE 41-13 Immediate Occupancy Performance Level

Building Description (separated by construction phases)

This new building includes classrooms, cafeteria, gymnasium, and covered play area. The structure consists of steel framing and precast concrete wall panels. This building was designed for seismic risk Category IV.

Seismic Assessment

Due to the recent year of construction, this is a “benchmark building” per ASCE 41-13 and was not evaluated during this assessment for structural deficiencies.

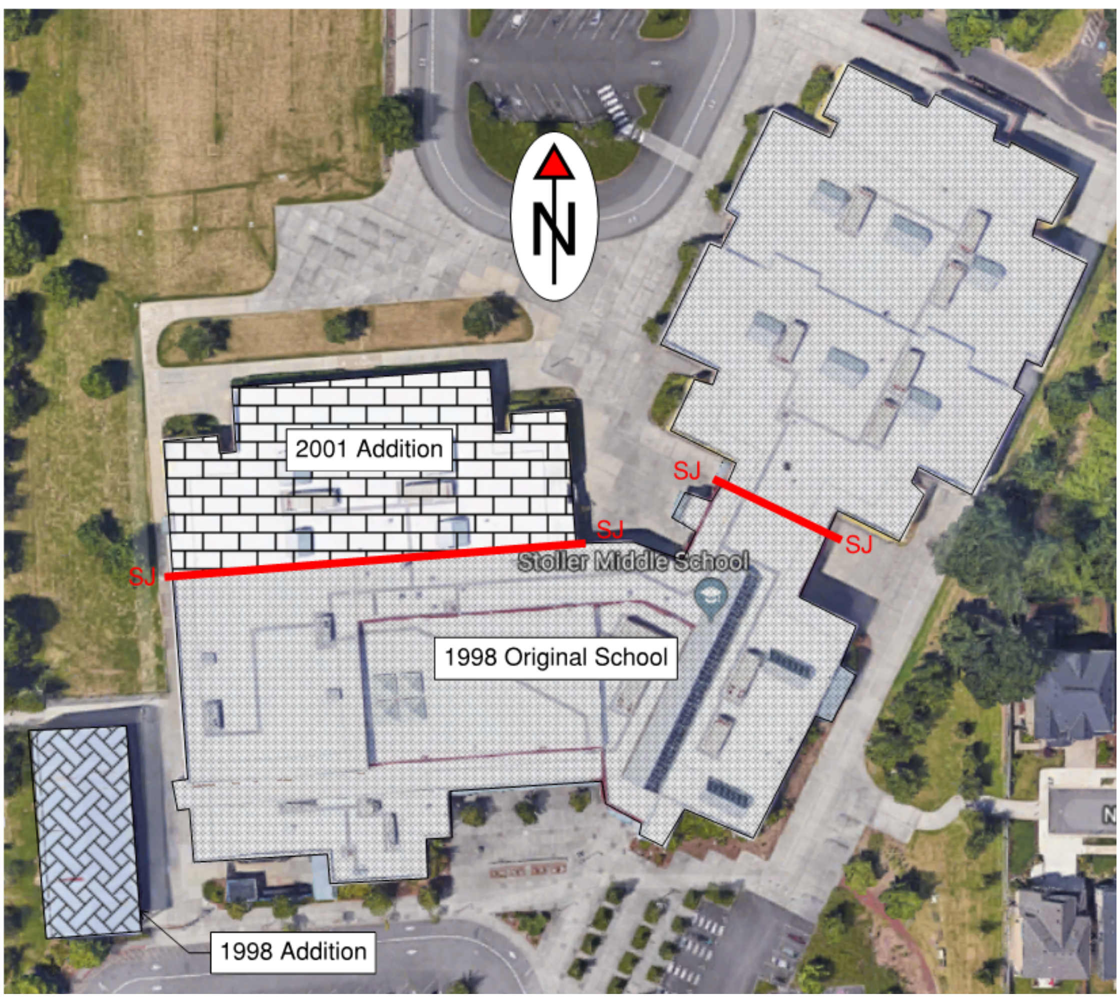
42: Stoller Middle School

<u>Building Summary and Building Year Plan</u>

Stoller Middle School was constructed in 1998, with an addition in 2001, and a covered play area with unknown building year. The original 1998 building drawings were not available during this assessment. It was observed during the site visit that the main building is a two-story building with a seismic joist separating the 2001 addition and a seismic joist separating the classroom wing from the administration wing.

The 1998 original building was observed to have masonry (assumed reinforced based on recent construction) (RM1) shear walls and wood shear walls (W2). The 2001 addition is separated from the original building with a seismic joint and was built with wood shear walls (W2).

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original building was constructed in 1998. It was observed on-site that the structure has masonry shear walls, which are assumed to be reinforced, and interior wood shear walls. The classroom wing and administration area are two stories tall and the gym/cafeteria and 2001 addition are a single-story. There is a seismic joint that separates the classroom wing, the gymnasium/administration area, and the 2001 addition.

The 2001 addition was constructed using wood shear walls along the exterior of the building and in various interior walls. There is a masonry façade along the exterior wood shear walls. There is a seismic joint separating the 2001 addition and the original structure. The 2001 foundation consists of a concrete slab-on-grade, spread footings for the tube steel columns, and strip footings under the shear walls. The roof structure has plywood sheathing (likely unblocked) which is supported by open web wood trusses. The trusses bear on either the wood shear walls or glulam beams. The glulam beams sit on tube steel columns which connect to the spread footings.

The covered play structure (unknown year of construction) is steel framed with masonry walls. It appears to have a moment frame in both directions for lateral resistance. The masonry walls are assumed to be reinforced horizontally so the walls can span horizontally between the CMU pilasters to avoid a falling hazard.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Unknown for original construction (likely only deficiencies are missing diaphragm blocking and diaphragm detailing around the roof pop-ups. The main overhead skylight did not appear to have lateral bracing but should be confirmed with the construction documents).

- 2001 roof diaphragm is not blocked but with further analysis, this potential deficiency may prove to be adequate.
- There are no ties between the foundation elements for the 2001 addition.

Summary of Seismic Nonstructural Deficiencies

- Sprinklers are not braced.
- Sprinkler head does not meet the minimum clearance.
- There is tall and narrow equipment that is not properly braced.
- Light fixtures were not independently supported in some locations.

Additional Structural Observations

- Cracking was observed in the CMU wall in the gymnasium. Based on our limited observations and the locations/direction of the cracks, it is likely temperature and shrinkage cracking.

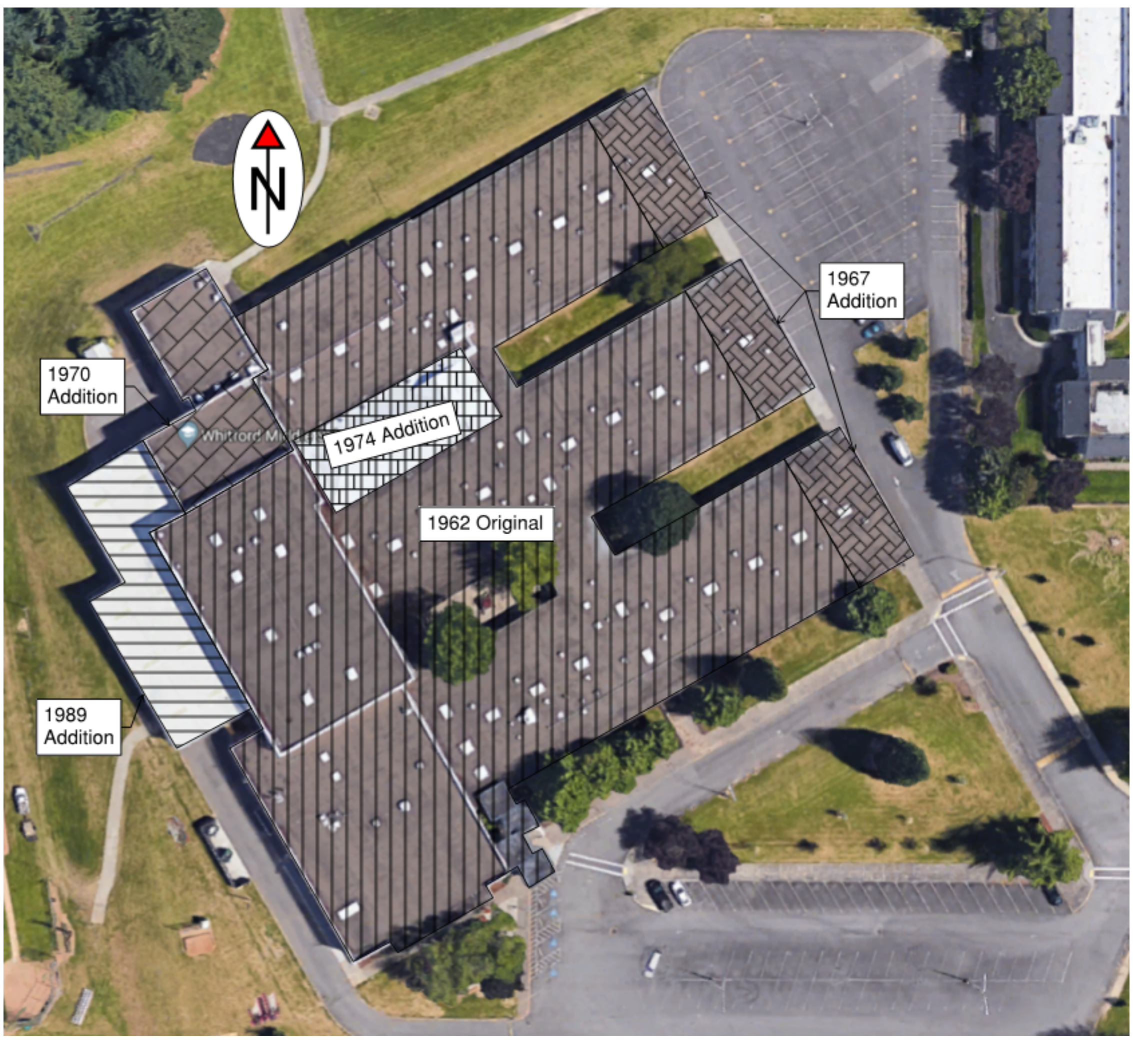
43: Whitford Middle School

Building Summary and Building Year Plan

Whitford Middle School was constructed in 1962, with additions in 1967, 1970, 1974, and a covered play area (unknown construction year).

The lateral force-resisting system consists of tilt-up concrete shear walls (PC1), a flexible plywood diaphragm roof in the classroom wings and a Tectum roof diaphragm at the gym and shop/wrestling room additions. The roof is primarily constructed of cambered glulam timber beams throughout and steel roof trusses at the gymnasium. Gravity support is provided by interior wood bearing walls, perimeter built-up steel columns, and concrete walls at the gymnasium. This building has not been seismically strengthened.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1964 construction and later additions are well documented and consistent using the same building scheme between the four middle schools listed:

- Cedar Park Middle School
- Meadow Park Middle School
- Highland Park Middle School
- Whitford Middle School

The lateral structure consists of perimeter tilt-up concrete walls spanning between steel columns and concrete pilasters. Interior wood bearing walls are not explicitly sheathed for any lateral performance. Foundations are typical concrete strip footings with concrete stem walls that extend up to meet either concrete or wood stud walls. Floor structure is reinforced concrete slab-on-grade with no direct connection to any foundation or stem walls. The diaphragm is connected to shear walls for in-plane load transfer, but lacks adequate connections for out-of-plane loading. The classroom wings contain plywood diaphragms while the gymnasium and 1970 addition contain Tectum sheathing.

Additional classrooms constructed in 1967 used existing structural elements to convert exterior covered space to additional classrooms.

The 1970 addition includes a metal shop and wrestling/activity room. Perimeter walls are constructed of tilt-up concrete, similar to the initial 1962 construction. Long span steel trusses comprise the roof structure of both areas and are sheathed with Tectum roofing.

The 1974 addition included a partial remodel of a classroom wing and enclosure of an existing exterior courtyard. Pitched glulam beams span existing bearing walls and are stabilized by steel tie-rods. Positive connections exist between structural members, but not directly to the diaphragm. The diaphragm is not fully blocked, and the structure lacks a complete load path between the beams and the diaphragm for in-plane and out-of-plane loading.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Exterior concrete walls are not adequately anchored to the diaphragm for out-of-plane forces (and potentially in-plane in some locations), which is typical throughout the building.
- Precast wall panels lack a positive connection to the foundation capable of developing strength of the wall.
- Classroom wings exterior walls contain "ribbon windows" and do not have any dedicated shear walls. Provide interior wood shear walls to address the diaphragm span deficiency.
- Classroom wing roof beams likely require strengthened connection to columns.
- Tectum roof at gymnasium, shop, and wrestling room are not capable of transferring lateral forces.
- A potential deficiency exists between diaphragms at the original construction and 1974 courtyard infill for both in-plane and out-of-plane load transfer.
- Re-entrant corners lack sufficient tensile capacity to develop strength of diaphragm.
- Cafeteria roof diaphragm requires strengthening as the span exceeds the capacity of an unblocked plywood diaphragm.
- The large concrete entry canopies require foundation and column strengthening or a full replacement. The individual inverted concrete shells pose a significant risk of failure right at the entry.
- Covered play area does not appear to contain a lateral force-resisting system and should be tied into the main building.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies

- Tall and narrow kitchen appliances.
- The drop ceilings in the administration area was unbraced.
- There are unbraced CMU Partitions in the locker rooms and in the 1970 addition.

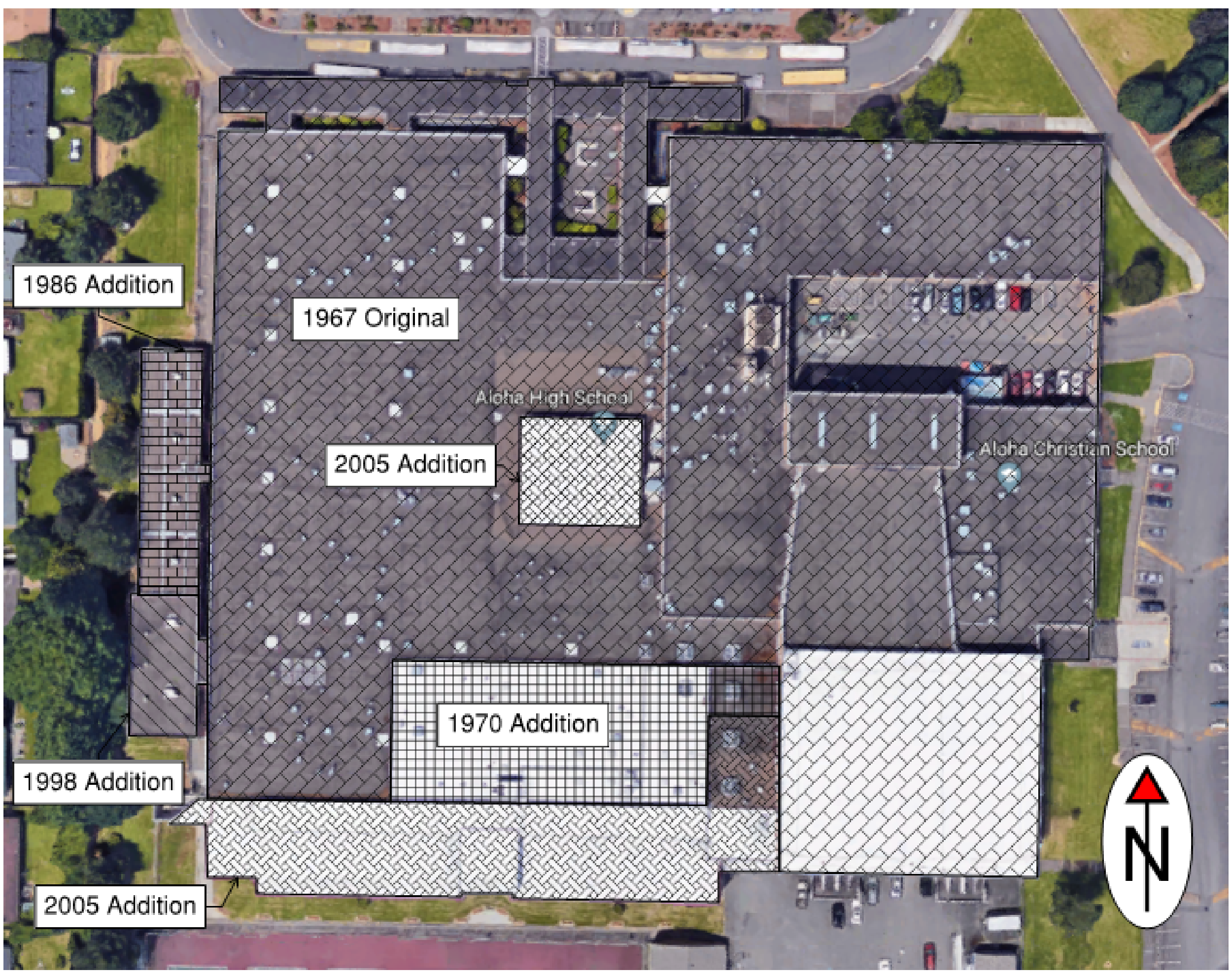
44: Aloha High School

This building is currently undergoing an ASCE 41-17 seismic retrofit under the State of Oregon's Seismic Rehabilitation Grant Program (SRGP). Design is underway, and construction is set to begin in 2019.

Aloha High School was built in 1967, with additions in 1970, 1986, 1998, and 2005.

The lateral force-resisting system for this structure is primarily exterior tilt-up concrete walls (PC1). There are a small number of existing wood framed shear walls and reinforced masonry shear walls at the classroom areas. The roof diaphragm is flexible plywood everywhere except over the gymnasium and 2005 addition, which consist of Tectum panels and metal roof deck respectively.

Building Risk Category IV
ASCE 41-13 Immediate Occupancy Performance Level (per SRGP requirements)



Building Description (separated by construction phases)

The original 1967 structure consists of classrooms, an auto shop wing, auditorium, gymnasium, entry canopies, and central courtyard area. The gravity system for the structure consists of exterior precast concrete walls and pilasters, interior wood bearing walls, and reinforced masonry bearing walls. These elements are supported by reinforced concrete shallow foundations and the main floor is a slab-on-grade. The lateral force-resisting system for the original building uses the exterior precast walls as shear walls as well as some miscellaneous interior masonry walls and wood walls. The roof system is primarily plywood sheathing over the majority of the building except over the gymnasium which uses Tectum roof panels. Wood members are used at the roof to support the majority of the structure except for at the gymnasium and auditorium, which has steel roof framing.

The 1970 addition added new classrooms to the south side of the original building. These classrooms are built primarily with wood and masonry walls at the interior and precast walls at south side exterior to match the rest of the building. The foundations and floor slab are reinforced concrete and the roof diaphragm is plywood sheathing. Wood trusses are used as the primary roof framing of this addition. The lateral force-resisting system for this addition is composed of exterior precast walls, as well as a connection to the original structure.

The 1986 addition is a standalone structure on the west side of the original structure with a covered walkway connection. This structure is built with exterior wood walls acting as both the lateral and gravity systems. The addition is on a slope, creating a tall crawl space on the west side of the structure. The sloping foundations are shallow reinforced concrete footings. The floor system is comprised of wood decking over glulam beams supported by wood posts that tie into the concrete foundations. The roof framing consists of wood joists with plywood sheathing acting as the roof diaphragm. There is a large parapet on the west side of this addition. The lateral force-resisting system is composed of the exterior plywood shear walls connecting to the wood floor and roof diaphragms.

The addition constructed in 1998 is south of the 1986 addition and contains a few classrooms and a walkway to the original structure. This addition is constructed in the same way as the 1986 addition and ties directly into that addition. The floor and roof are both wood framed and each use wood trusses and plywood sheathing.

The 2005 addition is a two-story addition built on the southern side of the original structure and 1970 addition. This addition primarily uses wood walls and masonry walls as the gravity and lateral force-resisting systems. Steel joists and girders are used at the roof and second floor. The lower floor is a concrete slab-on-grade tying into the shallow foundations. The roof diaphragm is flexible steel decking which is supported by steel roof framing.

Seismic Assessment

A full ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, Tier 1 evaluation was performed during the preparation for the seismic grant application. This report can be found on file with the Beaverton School District. A full list of deficiencies, seismic strengthening scheme and cost estimate is included in this report.

Summary of Seismic Structural Deficiencies

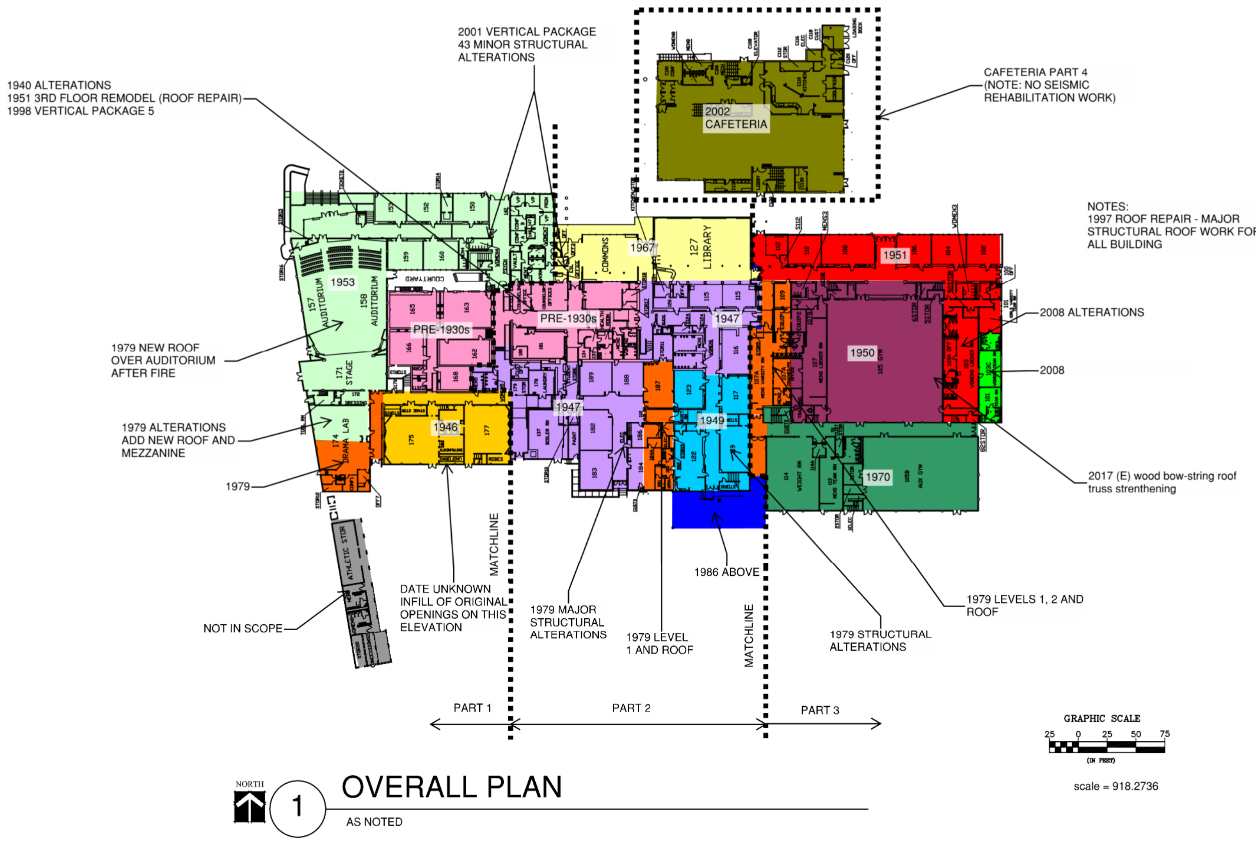
A full list of seismic deficiencies can be found in the comprehensive Tier 1 evaluation report. Deficiencies include lack of shear walls, diaphragm capacity/connections, and out-of-plane wall support.

45A & B: Beaverton High School (A: Main Building & B: Cafeteria Building)

Building Summary and Building Year Plan

The original construction of Beaverton High School dates to pre-1930, with approximately thirteen major structural additions and alterations over the past 90 years. An overall year plan is included below. To date, the building footprint is approximately 165,000 sf. About half of the building is two stories and the other half is single-story.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

Generally, the pre-1930s and 1946 construction is unreinforced masonry (URM) with wood floor and roof. The 1947, 1949, 1950, 1951, and 1979 construction has cast-in-place concrete walls and frames with wood floors and roof. The 1953 addition has concrete walls and frames with a concrete joist floor system and a wood roof. The 1967 addition has CMU walls with a wood roof. The 1970 addition has concrete tilt-up walls, with concrete interior walls and frames, a concrete joist floor system, and a steel framed roof with Tectum. The 1986 addition is cast-in-place concrete walls and frames with steel joist framed floors and roof. The 2002 Cafeteria is steel moment frames and CMU walls, with steel framed floor and roof. The 2008 addition is concrete tilt-up walls with steel framed floor and roof. The 2002 Cafeteria has steel moment frames and CMU walls, with steel framed floor and roof. The 2008 addition has concrete tilt-up walls with a steel framed floor and roof. In 1997, seismic roof level strengthening was performed that partially strengthened the diaphragm and connections to the diaphragm.

Seismic Assessment

A full ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, Tier 1 evaluation was performed during the preparation for the seismic grant application. This report can be found on file with the Beaverton School District. A full list of deficiencies, seismic strengthening scheme and cost estimate is included in this report.

It is important to note that the Performance Objective for the Beaverton High School was Life Safety for the purposes of the full Tier 1 evaluation and not Damage Control, which is the current goal of the district.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted. A full detailed list of deficiencies with photos can be found in the comprehensive full ASCE 41-17 report on file with the district.

- Given multiple additions, multiple alterations, and missing documentation, the lateral load paths are not well-defined.
- Inadequate lateral resistance: the pre-1930s construction appears to be URM perimeter walls which do not have adequate lateral resistance. There are also wall lines in the 1947, 1949, 1951, and 1953 construction that are almost all openings framed with lightly reinforced concrete spandrels and columns.
- Lack of out-of-plane bracing of walls and secondary gravity support below girders and trusses at the URM buildings.
- Lack of wall anchorage of wood floors to concrete or masonry walls.
- Wood floor and roof cross ties and sub-diaphragms are missing.
- Wood panel overlays on existing straight and diagonally sheathing floors are missing.
- Wood bow-string truss gravity strengthening: Although not a seismic deficiency, bow-string trusses typically have inadequate internal connections. We recommended that these trusses be rehabilitated.
- The 1950 gymnasium has a floating balcony concrete slab that is not anchored to the perimeter concrete walls.
- The 1986 addition is completely reliant on the noncompliant 1949 building for lateral support and lacks adequate ties.
- The 2008 addition concrete tilt-up panels are not anchored to the foundation.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Fire suppression piping bracing and flexible couplings.
- Emergency power for life safety systems anchorage or bracing.
- Stair smoke duct bracing.
- Sprinkler ceiling clearance.
- Hollow-clay-tile/URM partitions.
- Suspended gypsum board ceiling bracing.
- Overhead glazing.
- 1946 cavity walls construction, tie of outside wythe to interior and/or any added strongbacks.
- Tall narrow and fall prone contents.
- Tall narrow and fall prone equipment.
- Elevator retainer guards and retainer plates.

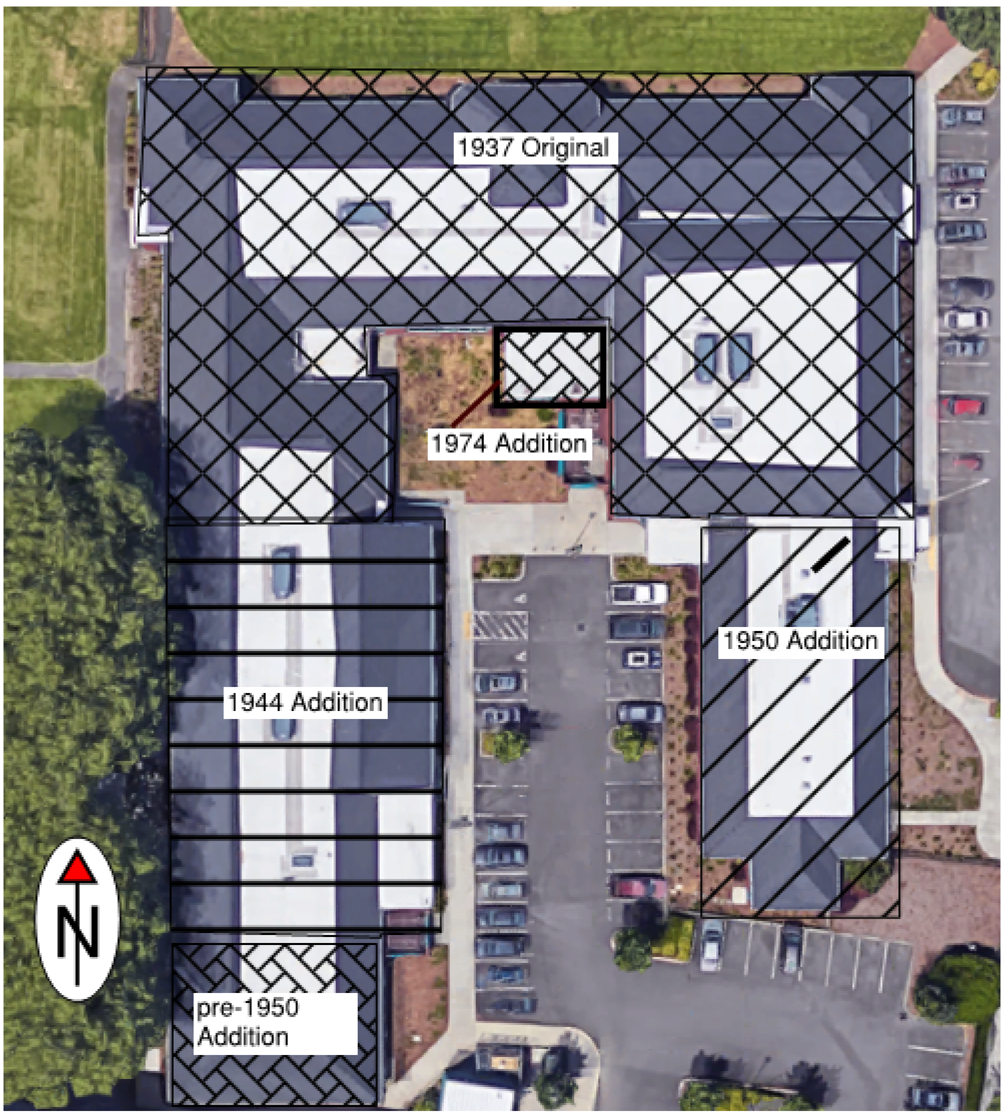
45C: Merle Davies

Building Summary and Building Year Plan

Merles Davies building annex was constructed in 1937 with additions in 1944, 1950, and 1974. Interior renovations and a seismic upgrade occurred in 2009.

The primary lateral system for this structure is wood framed construction (W2) with one building wing consisting of unreinforced masonry (URM) bearing walls. The roof diaphragm is a flexible plywood roof.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original 1937 building is a single-story structure containing classrooms and offices. The gravity system consists of timber roof truss on interior and exterior wood bearing walls. Exterior walls have brick veneer. The wood walls are supported by reinforced continuous concrete footings. The first floor is 2x joist construction supported by beams and posts. The posts are supported by unreinforced concrete spread footings. The original lateral system of the original building used 1x6 sawn sheathing at the roof diaphragm, and 1x6 wall sheathing at the walls. Orientation of the sheathing planks is unknown.

The 1944 addition is a classroom wing at the southwest corner of the original building. The gravity system consists of wood trusses on clay tile bearing walls (URM). Exterior walls have brick veneer. The walls are supported by continuous concrete footings. The lateral system consists of 1x sheathing of unknown orientation. The URM walls serve as the shear walls for this addition. Sometime prior to 1950, an extension was added to this classroom wing. The construction type of this extension appears to be similar to the 1944 addition.

The 1950 addition consists of a structure added to the southeast corner of the original building. The gravity system appears to consist of wood walls on a continuous concrete footing. The roof structure is wood roof trusses. The exterior walls have brick veneer. The lateral system consists of a 1x wood plank diaphragm of unknown orientation. The original in-plane wall bracing is unknown.

The 1974 addition consists of a small library addition in the courtyard of the original building. Gravity framing consists of wood roof joists on wood bearing walls. The first floor consists of wood joists supported by beams and posts. The perimeter foundation is a continuous concrete footing. The exterior walls have brick veneer. The lateral system consists of a plywood roof diaphragm and plywood sheathed wood walls.

In 1994, the southeast wing of the 1950 addition was remodeled for a food court. The existing roof and walls remained, but the floor was replaced by a slab on grade floor. New plywood sheathing was added to the exterior walls. The existing brick veneer remained.

In 2009, the original building received a building-wide seismic upgrade. The roof received a new plywood diaphragm over the existing sawn sheathing. Roof trusses were anchored to the clay tile walls in the 1944 addition. New plywood sheathed shear walls were added to the interior side of exterior walls. These walls were then anchored to the existing foundation with steel shear clips and hold-downs. Various foundation improvements occurred for new interior bearing walls and interior shear walls additions. Exterior veneer around building egress points were anchored to the backing structure with steel friction pins. The 1944 URM walls still remain as load bearing shear walls.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District, which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- URM shear walls in 1944 addition may be inadequate to resist lateral forces.
- URM shear walls have large aspect ratios making them susceptible to damage caused by out-of-plane forces. No out-of-plane bracing placed at all URM walls during the 2009 seismic upgrade. Also, it is unknown if the base of the URM walls are positively attached to the floor.
- No continuous cross ties at clay tile shear walls to distribute out-of-plane forces through the diaphragm.
- URM bearing walls do not have secondary gravity supports.
- Perimeter original straight sheathed wood walls may be overstressed.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

46: Mountainside High School

Building Summary and Building Year Plan

Mountainside High School was built in 2017 (designed by KPFF).

The primary lateral force-resisting system for this structure consists of steel buckling restrained braced frames and special reinforced masonry shear walls.

Building Risk Category IV
Roughly equivalent to ASCE 41-13 Immediate Occupancy Performance Level

Building Description (separated by construction phases)

The structure consists of steel framing and precast concrete wall panels. This building was designed for seismic risk Category IV.

Seismic Assessment

Due to the recent year of construction, this is a “benchmark building” per ASCE 41-13 and was not evaluated during this assessment for structural deficiencies.

47: Southridge High School

<u>Building Summary and Building Year Plan</u>

Southridge High School was constructed in 1998.

The Southridge High School building is a two-story building (PC1/RM1/S2a). The diaphragms consist of a bare metal deck at the roof and concrete on metal deck on the second floor. The lateral force resisting system consists of steel braced frames, reinforced CMU shear walls, and concrete tilt-up panels.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description

Southridge High School was constructed in one primary phase consisting of a main classroom wing, one auditorium wing, and one gymnasium.

The main classroom wing constitutes the majority of the building. It is a two-story concrete tilt-up building with CMU shear walls and steel braced frames (PC1/RM1/S2a). The roof consists of bare metal deck on wide flange beams and open web steel joists. These members are supported by interior steel girders and exterior concrete tilt-up walls.

The south entry contains a two-story round atrium. The roof consists of steel framing with infill glass. This framing is supported by two steel trusses and multiple concrete columns. The atrium appears to be laterally supported by the concrete columns. The columns are reinforced and founded on concrete spread footings.

The auditorium wing consists of a main auditorium, stage and related spaces, and separate music rehearsal rooms. The structure consists of a flexible metal deck diaphragm on reinforced CMU bearing walls (RM1). The roof above the seating area is a bare metal deck on open web steel joists. These joists are supported by reinforced CMU walls. The roof joists of the music rehearsal room portion are supported by steel columns on concrete spread footings. The fly tower roof of the auditorium is constructed of bare metal deck on open web steel joists and is also supported by reinforced CMU walls. All walls are supported by continuous concrete footings. The main floor is a slab-on-grade. The auditorium is laterally braced by the CMU bearing walls. The music rehearsal room portion of the building is laterally braced by CMU bearing walls and tube steel diagonal braces. The auditorium wing is seismically isolated from the main classroom wing with a seismic joint.

The attached gymnasium is a two-story steel building. The roof is bare metal deck on steel trusses which are supported by exterior concrete tilt-up walls. The second floor is composite concrete on metal deck and is supported by interior steel girders and steel columns. The exterior framing is above a clear story and is supported by steel tubes with a concrete tilt-up wall below. The first floor is a slab-on-grade. The foundation consists of interior concrete spread footings and exterior continuous concrete footings. The perimeter tilt-up panels provide lateral support for the gym. The clear story framing is braced with diagonal steel angles. There is one interior CMU shear wall that helps laterally brace the second floor.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit

damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Shear wall and braced frame locations are not evenly distributed throughout the building which may cause excessive torsional effects that the lateral force-resisting system is not capable of resisting.
- Column axial stress may be compromised by overturning forces due to lateral loads. Further analysis may show this condition to be adequate.
- Diagonal braces may be undersized to resist lateral loads. Further analysis may show this condition to be adequate.
- Diagonal brace connections may be undersized to develop brace buckling and yielding capacities.
- 7 inch diagonal tube braces do not meet moderate ductility requirements.
- Beams in diagonal braces may be inadequate to resist vertical loads delivered by braces.
- Lack of continuous cross ties at the class wing roofs will likely cause separation between the roof and tilt-up panels/CMU walls at sector G during a seismic event.
- CMU and tilt-up bearing walls throughout the building may be inadequately detailed to resist lateral loads resulting from building drift.
- Wall anchorage to tilt-up panels and CMU walls may be inadequate to resist out-of-plane forces from diaphragm. Further analysis may show this condition to be adequate.
- Shear capacity in tilt-up and CMU shear walls may be inadequate to resist shear stresses resulting from lateral loads. Further analysis may show this condition to be adequate.
- Thickness of tilt-up wall does not meet 1/40 aspect ratio limit for unsupported heights.
- Seismic isolation joint at auditorium is inadequate to handle horizontal displacement in two directions.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Unbraced fire lines at second floor.
- Light fixtures and air ducts in fly tower storage are unbraced.
- Unbraced lights and unbraced suspended art panels in tall hallway to commons.
- Unbraced audio speakers in main gym.
- Air ducts in main entry airlock are unbraced.

- Little to no pipe bracing in boiler room.

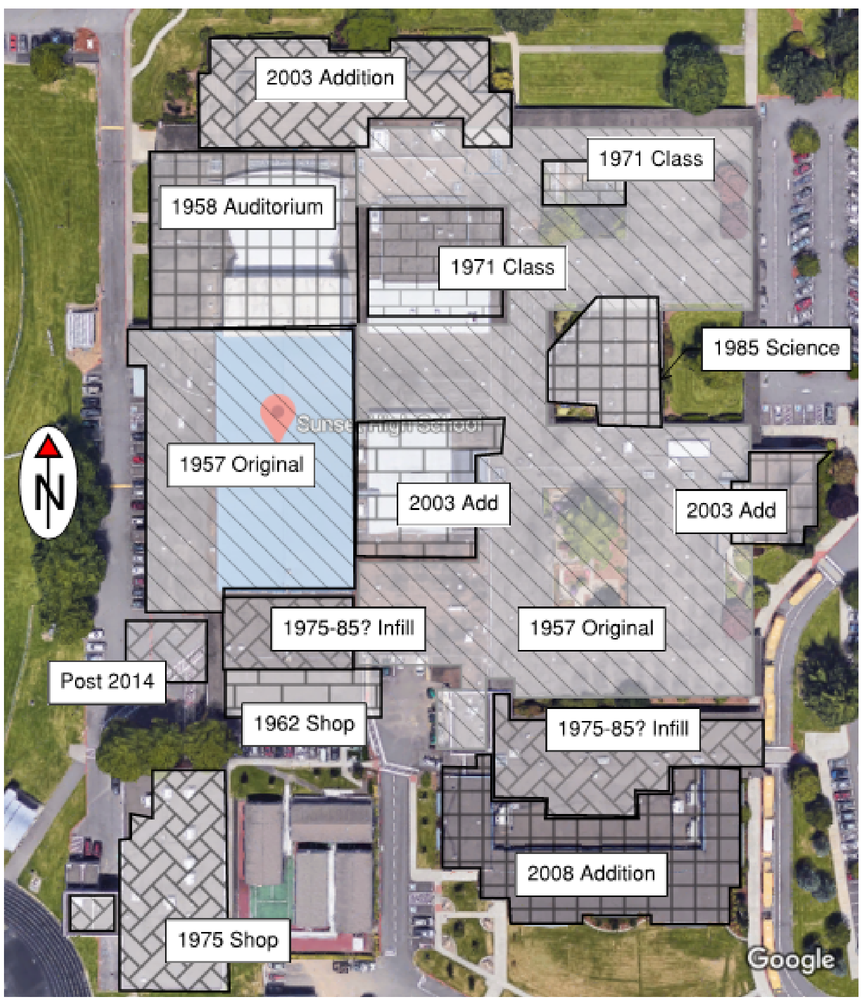
48: Sunset High School

Building Summary and Building Year Plan

Sunset High School was constructed in 1957 with additions in 1958, 1962, 1971, 1975, 1985, 2003, and 2008. There was a 2014 roofing upgrade at the auditorium and gymnasium.

The original building is a single-story wood building (W2) with plywood sheathed walls and wood sheathing at the roof level. The 1958 addition is a concrete tilt-up walls (PC1) structure with a plywood diaphragm at the roof. The 1958 auditorium is a cast-in-place (C2/C2A) wall system with plywood and concrete diaphragms. The 1962 shop addition, two 1971 additions, two 1975-85 additions, 1985 science addition, and 2003 addition are wood structures (W2) with plywood sheathed walls and wood sheathing at the roof level. There is also a one recent (post 2016) isolated wood building (W2) with plywood sheathed walls and wood sheathing at the roof level.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



ELEMENTARY SCHOOLS
MIDDLE SCHOOLS
HIGH SCHOOLS
OPTION SCHOOLS
SUPPORT FACILITIES

Building Description (separated by construction phases)

The original building is a single-story structure with a large mezzanine serving as an auxiliary gymnasium to the main gymnasium. The main building is post and beam wood construction (W2). The roof consists of sheathing on 2x joists and glulam girders. The exterior walls are constructed with 2x wood stud framing with brick veneer. The building is supported laterally with interior gypsum sheathed wood shear walls and exterior plywood sheathed wood shear walls. There is an attached gymnasium that consists of a steel beam and tilt-up concrete wall construction (PC1a). The concrete walls provide lateral support for the gymnasium. The foundation systems for both building types consist of interior concrete spread footings and continuous concrete footings at the building perimeter.

The attached auditorium was constructed in 1958 and consists of a combination of plywood roofs and concrete roofs with reinforced concrete walls (C2/C2a). The plywood roof (originally Tectum but replace with plywood in 1995) consists of 2x joists and steel trusses which are supported by interior steel columns. The concrete roof is supported by exterior and interior concrete walls. The foundation systems consist of a combination of interior concrete spread footings and interior and exterior continuous concrete footings. Lateral loads are transferred to the foundation via the concrete walls.

In 1962 an attached wood framed (W2) shop was added to the south side of the original building. The roof is constructed of plywood on 2x joists and glulam girders. The girders are supported by wood posts. Infill wood walls consist of 2x stud framing with brick veneer. The building is supported laterally with exterior plywood sheathed walls. The foundations consist of isolated spread footings.

Two classroom additions were added as infills in the original building courtyards in 1971. Both structures are wood construction (W2) and consist of plywood roofs on 2x joists and glulam girders. The girders are supported by steel columns. The foundations consist of isolated concrete spread footings and continuous concrete stem walls. The lateral force-resisting system consists of a plywood sheathed roof diaphragm with plywood sheathed shear walls.

In 1975 a single-story detached shop was constructed to the south of the main building. The construction appears to be constructed with wood walls and a wood roof (W2), but more detailed information could not be determined due to the poor condition of the as-built drawings.

Two more additions were added to the south of the building sometime between 1975 and 1985. One addition is located between the original gymnasium and 1962 shop. The other is attached to the southeast corner of the building with a narrow courtyard in between. Both structures are post and beam wood construction (W2).

A new single-story science wing was added to the east courtyard in 1985. This wing is wood construction (W2). The roof is plywood on 2x wood joists. The joists are supported by glulam girders, 2x wood bearing walls, and reinforced CMU walls. There is brick veneer on the exterior walls. The wing is laterally supported by plywood sheathed wood shear walls on the exterior and gypsum sheathed walls on the interior. The foundation consists of both concrete spread footings and continuous concrete footings.

Three more classroom additions occurred in 2003. These additions consisted of a new east wing, northwest wing, and student commons. The roof of the east and northwest wings is constructed with plywood on TJL joists. These roofs are supported by sheathed 2x wood stud bearing walls which also provide lateral support. The foundations consist of continuous concrete footings. The student commons was an infill of one of the building courtyards. Its roof is constructed with metal deck on open-web steel joists and steel beam girders. The girders are supported by steel tube columns on spread concrete footings. The lateral forces are resisted by the plywood sheathed roof diaphragm and interior plywood sheathed 2x walls.

In 2008, a classroom wing addition was added to a previous addition on the south side of the building. Primary framing consists of wood construction (W2), which includes tongue and groove plywood on TJW joists. The joists are supported by 2x wood stud bearing walls and glulam beams. The structure is laterally supported by the wood roof diaphragm and plywood sheathed walls. All gravity and lateral loads are transferred to the ground via continuous interior and exterior concrete footings.

A relatively small amount of roof strengthening was provided in 2014 to improve roof to wall connections. Work was limited to the auditorium and gymnasium concrete wall to roof connections and also included roof to CMU connections at the science wing. The improvements consisted of hold-down anchors with blocking through multiple bays of framing to develop the strap tension forces.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Existing wall anchorage at the CMU at the science wing and concrete walls at the gym and auditorium may be inadequately sized for out-of-plane lateral loads. Further analysis may show this condition to be adequate. Anchors do not provide continuous support between diaphragm chords.

- Seismic separation is needed to isolate stiffer gym and auditorium structures from wood building.
- Long window lines at exterior elevations create weak lines of lateral support.
- Existing shear walls may be inadequate to resist lateral forces. Further analysis may show this condition to be adequate.
- Narrow shear wall present at east wall of shop addition.
- Lack of roof chord continuity at roof pop-ups: study hall and student center.
- Large spans of wood diaphragms may be inadequate to resist lateral loads. Further analysis may show this condition to be adequate.
- Lack of sufficient panel edge blocking at large span diaphragm.
- Concrete walls in auditorium may be inadequate to resists shear loads. Further analysis may show this condition to be adequate.
- Concrete walls in auditorium may not be anchored or doweled into the footings.
- Likely deficiencies in deflection compatibility for pilasters in auditorium due to lateral drifts.
- Lack of sufficient coupling beam reinforcement at auditorium.
- Large openings in auditorium south walls may be inadequate to resist lateral loads. Further analysis may show this condition to be adequate.
- Tectum roof at gymnasium. New 2014 sheathing at roof could not be observed. Unknown sheathing attachments to support framing and which may be inadequate.
- Concrete tilt-up walls at gymnasium may be inadequate to resist lateral loads. Further analysis may show this condition to be adequate.
- Concrete tilt-up walls at gymnasium may be too thin to span floor to ceiling.
- Concrete tilt-up walls at gymnasium likely have inadequate positive connections to footings.
- Girders connections to the concrete tilt-up walls at gymnasium may be undersized.
- Re-entrant corners throughout building may lack sufficient tensile capacity to develop strength of diaphragm.
- Masonry bearing walls encountered in F Hall entry. Some are full height and others are half-height creating structural “hinge”.
- Half-height masonry bearing wall at trash enclosure on south side. This wall supports main building.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

<u>Summary of Seismic Nonstructural Deficiencies</u> (included in cost per square foot above)

- Gas line spanning between original building and new isolated building without flexible joints.
- Large unbraced fan units hang off wall in gym.
- Low hanging light fixtures encountered in the A wing/multi-purpose wing.
- Some fire lines in corridor hang 12 inches or greater from ceiling.
- A utility building which is relatively tall for its width was encountered on east side of building. No access. Masonry veneer or bearing walls.
- Single-pan annealed glassed encountered in C Hall. Could be a brittle material hazard.

- Many unbraced overhead pipes in the boiler room. Mechanical floor equipment appears to be secured to the floor.
- A few unbraced masonry parapets at roof.

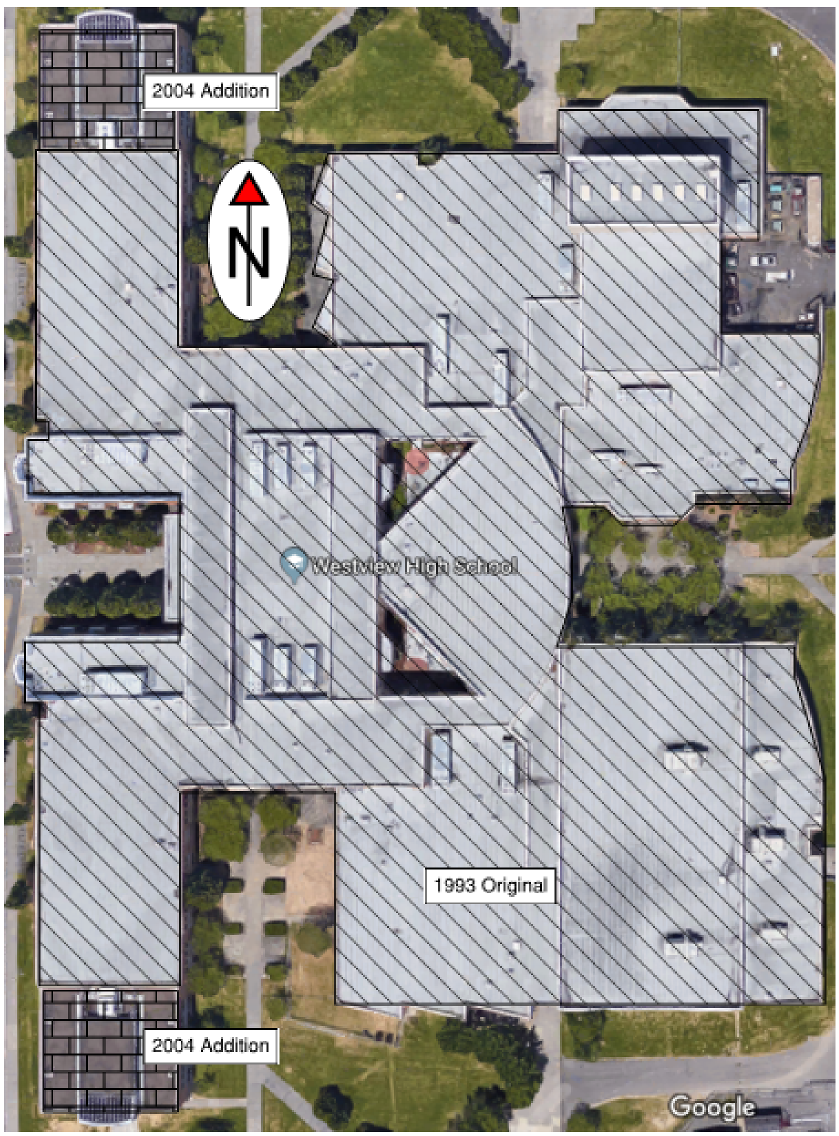
49: Westview High School

Building Summary and Building Year Plan

Westview High School was constructed in 1993 with two additions in 2004.

The original building is a two-story steel building (S2/S2a/RM1/C2) with braced frames, CMU shear walls, and concrete shear walls. There are both bare metal deck and concrete on metal deck diaphragms. The 2004 additions are two-story steel braced frame structures with both bare metal deck and concrete on metal deck diaphragms.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original Westview High School structure consists of a two-story main building with an attached gymnasium and auditorium.

The main building is a two-story steel framed building (S2/S2a). Its roof is a bare metal deck on open web steel joists supported by steel girders and steel tube columns. The second floor is a composite concrete on metal deck supported by steel beams and interior and exterior steel tube columns. The perimeter walls are constructed with metal stud infill framing with brick veneer. The first floor is a slab-on-grade. The foundation consists mainly of spread footings and thickened slab edges. The student center roof consists of metal deck on a steel pipe space truss. These trusses are supported by steel columns and reinforced concrete columns on spread footings.

The main building is laterally braced by various bracing systems. The east classroom wings of the main building are laterally supported by two-story chevron braces, or eccentrically braced frames (EBF). The library area is laterally supported by a combination of two storied concrete shear walls and EBFs. The single-story north wing and south classroom wings are supported by concrete shear walls and tie rod braced frames. The student center portion appears to be laterally supported by cantilever concrete columns. These columns are founded on concrete footings and are connected by a grade beam.

The attached gymnasium is a two-story CMU and concrete structure with flexible and rigid diaphragms (RM1/C2). The roof is bare metal deck on steel joists. The joists are supported by interior steel columns and exterior CMU bearing walls. The second floor is a composite concrete on metal deck system supported by steel beams. Beams are supported by interior steel columns and exterior concrete bearing walls. Some exterior concrete walls also act as soil retaining walls. Some exterior walls also contain precast concrete panel fascia and brick veneer. The main floor is a slab-on-grade. The foundation is composed primarily of interior spread footings and exterior continuous footings. The gymnasium is laterally braced by reinforced CMU at the upper level and reinforced concrete walls at the main level.

The attached auditorium consists of a tall ceiling above the seating area and a fly tower above the stage area. The structure consists of a flexible metal deck diaphragm on reinforced CMU bearing walls (RM1). The roof above the seating area is a bare metal deck on open web steel joists. These joists are supported by reinforced CMU walls. The tower roof is constructed of bare metal deck on tube steel beams and is also supported by reinforced CMU walls. The main floor is a slab-on-grade. All walls are supported by continuous concrete footings. Lateral forces are transferred to the ground via the same reinforced CMU walls.

In 2004 a two-story classroom structure was added to the northwest and southwest classroom wings. The addition is a steel framed structure and is similar to the original building. The addition is laterally supported by EBF frames single diagonal frames.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Wall anchorage at CMU and concrete walls may be inadequately sized for out-of-plane forces. Further analysis may show this condition to be adequate.
- Shear wall and braced frame locations are not evenly distributed which may cause excessive torsional effects that the lateral force-resisting system is not capable of resisting.
- Column axial stress may be compromised by overturning forces due to lateral. Further analysis may show this condition to be adequate.
- Chevron braces may be undersized to resist lateral. Further analysis may show this condition to be adequate.
- Chevron brace connections may be undersized to develop brace buckling and yield capacity.
- Chevron braces do not meet moderate ductility requirements.
- Beams in chevron braces may be inadequate to resist vertical loads delivered by braces.
- Lack of continuous cross ties at the class wing roofs will likely cause separation between the roof and concrete walls during a seismic event.
- Concrete shear walls may be inadequate to resist overturning due to lateral. Further analysis may show this condition to be adequate.
- Shear capacity in the narrow concrete shear walls may be inadequate to resist shear stresses resulting from lateral loads.
- Concrete gravity columns in the student center may be inadequately detailed to resist lateral loads resulting from building drift.
- CMU shear wall capacity may be inadequate to resist shear stresses from lateral loads. Further analysis may show this condition to be adequate.
- CMU horizontal wall reinforcement is lightly reinforced and likely to be adequate.

- Lack of continuous cross ties at the auditorium and gymnasium roof will likely cause separation between the roof and CMU walls during a seismic event.
- New northwest and southwest wing additions have seismic joint at main building interface at each level. However, there appears to be one line of lateral resistance in east-west directions only at additions.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Structural Deficiencies

- Fire line runs parallel with the seismic joint. Could not visually verify if the line crosses the joint at some other location.
- Several half-height and full-height CMU partitions were encountered in corridors throughout. Full-height partitions do align with beam lines, but connections at these beams could not be visually verified.
- Very tall CMU bearing walls at fly tower. Check reinforcement.
- Low hanging light fixtures in main west entry.
- Unbraced CMU partition wing walls in weight room.
- Large round ducts in main gym and upper gym may need additional bracing.
- Overhead pipes in boiler room appear to be braced in some but not for all continuous runs.
- Low hanging lighting frame in Rooms N134 requires bracing.

50: Arts & Communication ACMA School

Building Summary and Building Year Plan

New school to be constructed in 2019 (designed by DLR Group). Existing 2009 Performance Arts Center to remain.

The primary lateral force-resisting system for this structure consists of steel buckling restrained braced frames.

Building Risk Category IV (III for Performing Arts Center)
Roughly equivalent to ASCE 41-13 Immediate Occupancy Performance Level (Damage Control for Performing Arts Center)

Building Description (separated by construction phases)

A new school building is to be constructed in 2019 replacing the building originally constructed in 1948. The 2009 Performing Arts Center is to remain. The new structure will contain classrooms, a large commons area, and a kitchen. The new building will connect to the Performing Arts Center that was built in 2009 and designed by James G. Pierson structural engineers. The 2009 building was designed for a seismic risk Category III and the 2019 building is being designed for seismic risk Category IV.

Seismic Assessment

Due to the recent year of construction, this is a "benchmark building" per ASCE 41-13 and was not evaluated during this assessment for structural deficiencies.

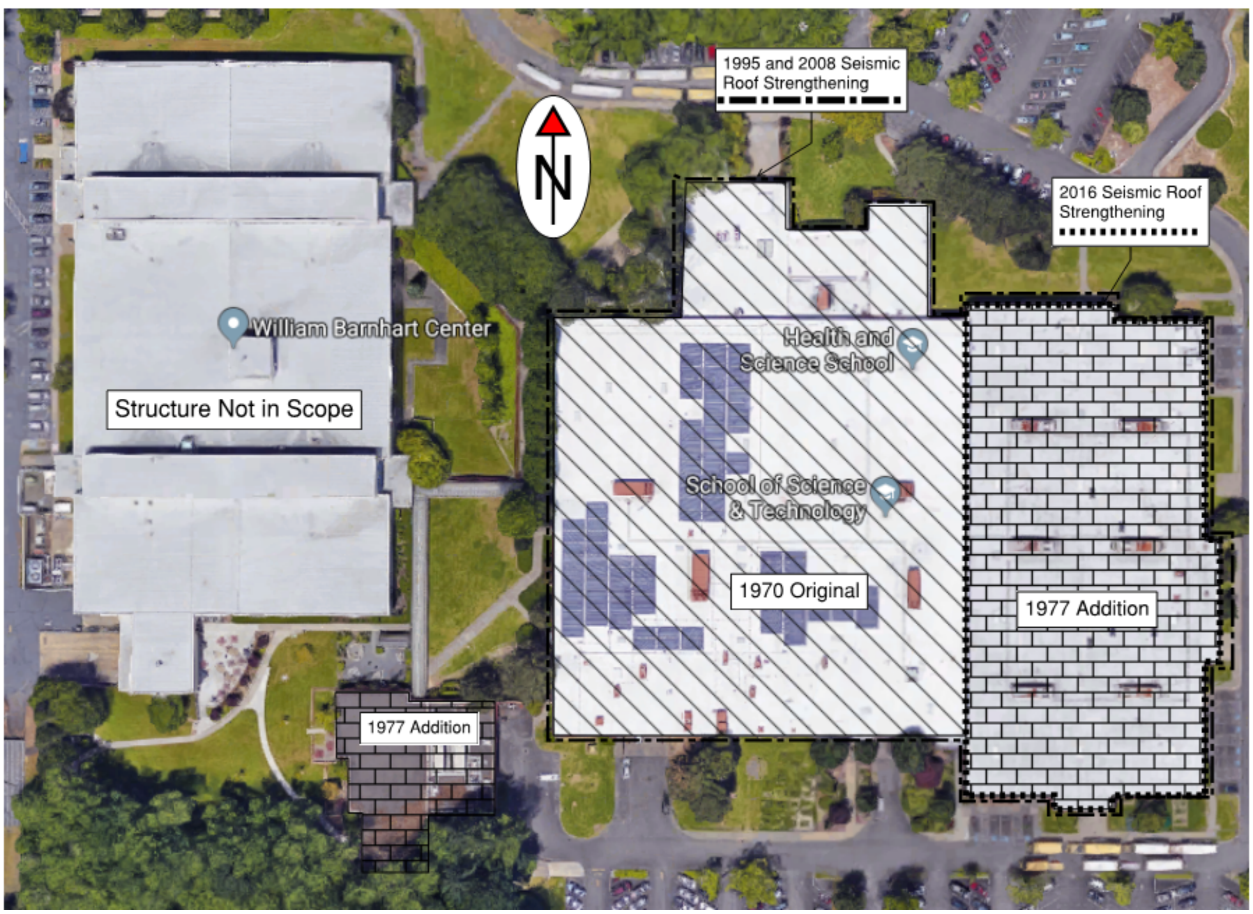
51: Capital Center – Health & Science School

Building Summary and Building Year Plan

The Capital Center was constructed in 1970 in Beaverton, Oregon. There were additions in 1977 as well as a re-roofing and seismic upgrade in 2016. It consists of a single-story main building (1970), an attached single-story addition (1977), and one detached addition (1977). The building to the west was constructed in 1978 and was not reviewed in this assessment. There were partial seismic upgrades completed in both 1995 and 2008.

The lateral force-resisting systems for the 1970 and 1977 additions are primarily constructed of a concrete tilt-up shear wall (PC1) along the exterior of the building. The roof system is plywood decking. The 1977 standalone addition is constructed of precast concrete tilt-up panels (PC1) and a plywood roof deck. In 1995, new wood shear walls and foundations were added. In 2008, diaphragm strengthening was completed along with out-of-plane bracing for the concrete shear walls.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original building, constructed in 1970, is a single-story precast concrete tilt-up panel building. The roof is framed with plywood, which is supported by glulam beams and glulam girders with circular tube steel columns as supports. The reinforced concrete tilt-up panels are along the perimeter of the building, but most panels are not full height and do not tie into the roof framing to provide in-plane lateral support. The foundation consists of a concrete slab-on-grade with thickened slab edges and spread footings which support the interior columns. There are very few dowel bars connecting the precast walls and the foundations, which are likely to be structurally deficient. In the 1995 seismic upgrade, wood shear walls were added to split up the span of the roof diaphragm. The wood shear walls are connected to the roof diaphragm and tied into the concrete slab-on-grade. In 2008 there was a re-roofing project that included out-of-plane seismic strengthening that tied the tilt-up concrete walls to the roof diaphragm.

The attached addition, constructed in 1977, is a single-story precast concrete tilt-up panel building. Its roof is framed using the same type of construction as the main building. The west end of the addition connects to the existing precast panels from the 1970 building. The foundation for the addition is similar to the main building. In the 1995 seismic upgrade, wood shear walls were added to split up the span of the roof diaphragm. The wood shear walls are connected to the roof diaphragm and tied into the concrete slab-on-grade. In 2008 there was a re-roofing project that included out-of-plane seismic strengthening that tied the tilt-up concrete walls to the roof diaphragm. There was a re-roofing in 2016 which added strapping and blocking as well as two wood shear walls. The wood shear walls are tied in to new strip footings and into the roof framing above.

The single-story detached building addition was constructed in 1977. It consists of precast concrete tilt-up shear walls with a glulam roof supporting plywood roof sheathing. The building is torsionally irregular because the roof framing extends past the concrete tilt-up shear walls in the southwest side of the building. The foundation is a combination of a concrete slab-on-grade and strip footings which supports the concrete panels. The slab-on-grade has slab steps throughout the building and is tied together utilizing concrete stem walls. The strip footings do not tie into the concrete walls. The roof decking attaches to the concrete walls by framing into the side of the walls on a wood ledger and is tied into the wall with strapping. The glulam beams frame into the concrete walls and are connected utilizing precast anchors.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

1970 &1977 Addition:

- The roof diaphragm does not have direct in-plane attachments to the concrete shear walls. In 2008 – the out-of-plane connections were added.
- For the 1970 building: concrete tilt-up walls only have dowels into the foundations at wall joints. It is assumed that there are not enough dowels to be structurally acceptable. The 1977 addition does not have dowels connecting the walls and the foundations.
- Shear walls added in 1995 do not all have new foundations and likely need strengthening.
- Collector strapping does not exist to drag load from the diaphragm to the 1995 wood shear walls and should be added.
- The concrete walls do not pass the minimum wall thickness check for out-of-plane loading.
- There are no ties between the foundation elements.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site

1977 Separate Building:

- The roof diaphragm puts wood ledgers into cross-grain bending.
- The shear walls do not have dowels connecting into the foundations.
- The concrete walls do not pass the minimum wall thickness check for out-of-plane loading.
- There are no cross ties in diaphragm chords.
- The site slopes to the southwest and slope stability issues should be further explored.
- There are no ties between the foundation elements.
- The difference of the center of mass and the center of rigidity is assumed to be more than 20% of the building width because of the shear wall layout. This causes a torsional irregularity.

Summary of Seismic Nonstructural Deficiencies:

- Fire Suppression piping is not braced.
- Sprinkler head clearance is noncompliant.
- Lights are not independently supported in the 1970 building.
- Drop ceilings are not braced in the 1970 building.

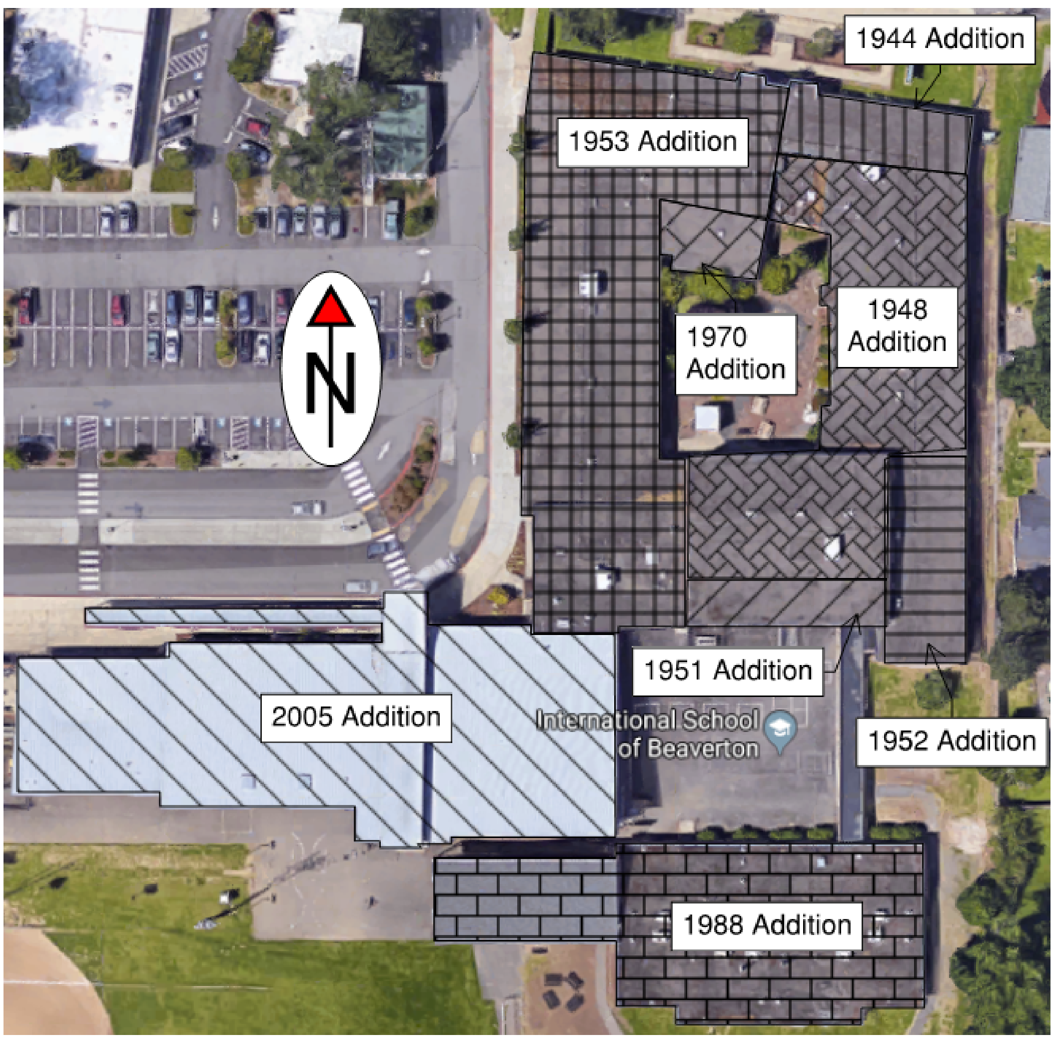
52: International School

Building Summary and Building Year Plan

The original building was constructed in an unknown year but was demolished during the 1953 addition. The oldest portion of the school that is still remaining was constructed in 1944. There were additions in 1948, 1951, 1952, 1953, 1970, and 2005. There is also a modular building which was constructed in 1988. In 1979, a new wood shear wall was added in the 1953 addition.

The structure of the main building (1944-1970) has a lateral force-resisting system consisting of wood shear walls, concrete partial basement shear walls, and typically a straight sheathed diaphragm with diagonally sheathing in the original gymnasium/auditorium. The 1988 addition is wood framed with a plywood diaphragm. The 2005 addition contains CMU shear walls and steel braced frames with a metal deck diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The 1944 addition is single-story building constructed of concrete strip footings, straight sheathed wood shear walls, and a shiplap diaphragm. There is a crawl space under the first floor in both the hallway and in the classrooms. The first floor is constructed of wood joists spanning between the strip footings and supporting a plywood deck. All of the brick along the exterior is nonloadbearing and acts only as a veneer. There is a URM parapet around the original front entry of the building on the north side.

The 1948 addition consists of a single-story structure which includes additional classrooms and a gymnasium. The classroom section of the building is similar to the 1944 addition as it has straight sheathed wood shear walls, a plywood roof diaphragm and concrete strip footings. There is also a crawl space under the first floor. The gymnasium has a wood truss roof system which supports wood joists and a diagonally sheathed diaphragm. There is a crawl space that is constructed similarly to the 1944 addition.

The 1951 addition is a single-story wood building with a basement. The basement has concrete retaining walls around the perimeter. The first floor has a wood diaphragm which ties into the concrete retaining walls at the top. The roof structure is a continuation of the wood trusses from the gym and the diaphragm for the roof is constructed of wood shiplap.

The 1952 addition added two new classrooms off of the 1948 and the 1951 additions. This addition is a single-story wood shear wall building with strip footings and a shiplap wood diaphragm. There is brick veneer along the exterior of the building and a crawl space similar to the 1944 building addition.

The original building was demolished and replaced with the 1953 addition. There were several classrooms added as well as an administrative area, cafeteria and small library. This addition continued the same framing as the previous additions with straight sheathed wood shear walls, concrete strip footings and a crawl space under the first floor. The roof diaphragm also has the same wood shiplap as the other additions. The cafeteria has a taller roof height than the rest of the addition, and the wood shiplap roof diaphragm is supported with open web wood joists. A new plywood shear wall was added in the administrative area in 1979. This wall attached to the roof diaphragm and connects into an existing concrete strip footing.

The 1970 addition expanded the library that was added in the 1953 addition. The library addition is a single-story building constructed of wood shear walls, concrete strip footings and a wood shiplap diaphragm.

In 1988 a modular building with a covered play area was added. The addition is a single-story plywood and masonry shear wall building, with concrete strip footings and a plywood roof diaphragm. The gravity system is constructed of glulam beams at the roof, with steel tube columns supported by circular concrete spread footings. There is also a crawl space underneath the first floor. A covered play area was constructed along the west side of the building. The covered play area is constructed of glulam beams, concrete spread footings, and tube steel columns. The play area relies on the modular building for lateral support.

The 2005 addition is a single-story building constructed of masonry shear walls and steel braced frames. The roof has a plywood diaphragm and the footings are constructed of concrete slab-on-grade, concrete strip footings, and concrete spread footings. The metal roof deck is supported by steel wide flange members and steel open web trusses. This addition contains classrooms, a cafeteria, and a covered waiting area for the busses.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- There is no connection shown in the drawings between the shear walls and the roof diaphragm and between the wood shear walls and the wood sills in building years 1944, 1948, 1951, 1952, and 1953.
- The diaphragm is not continuous where the classrooms meet the original cafeteria and the gymnasium and is not tied together.
- Roof chord continuity is disrupted where the roof steps occur between the classroom sections of the original building, the original cafeteria, and the gymnasium.
- The roof diaphragm in building years 1944, 1948, 1951, 1952, and 1953 are constructed with shiplap, which is a tongue and groove decking acting as a straight sheathing.
- There are tall narrow wood shear walls that resist seismic forces and have an aspect ratio less than 2-1.
- In the modular building there is no connection between the wood shear walls and the foundations, and between the wood shear walls and the wood diaphragm.
- The roof diaphragm connection to the top of the masonry shear wall puts the wood ledger into cross-grain bending.
- The covered play area relies on the modular building for its lateral support. It is assumed that the connection is inadequate. This connection causes the play area to be put into torsion.

- There are posts in the crawl space of the 1988 addition that do not have a positive connection to the foundation, and the floor beams do not connect to the wood posts with a positive connection.
- The diaphragm for the modular building and the main building (except for the 2005 addition) is assumed to not be blocked, has spans greater than 40 ft, and needs to be strengthened.
- The masonry wall in the modular does not meet the minimum reinforcement criteria.
- There are noncontinuous cross ties between diaphragm chords.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site

<u>Summary of Seismic Nonstructural Deficiencies</u>

- Fire suppression piping was not braced in the modular building.
- There was no clearance for the sprinkler heads in the modular building.
- The drop ceilings were not braced in the modular building.
- There is a tall unbraced masonry parapet over the main entrance.

<u>Additional Structural Observations</u>

- In addition to the seismic structural deficiencies, during our site visit we discovered that the wood members of the wood trusses in the gymnasium were splitting at the single bolted connections. It is a high priority to investigate this observed structural damage further and take action to remedy. It is our understanding that the district is already proceeding with action for these trusses.

53: Merlo Station Community School

Building Summary and Building Year Plan

The Merlo Station Community School was constructed in 1979 with a roof upgrade in 2018. The building is single-story with precast tilt-up shear walls (PC1) and plywood sheathing at the roof level. There was a 2018 re-roofing project that was in construction during the site visit. This re-roofing project did not include seismic strengthening.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The building was constructed in 1979 and served as a support facility for the school district before being converted into an alternative high school. The foundation was built with a concrete slab-on-grade and a concrete strip footing. The lateral force-resisting system consists of concrete tilt-up panels along the perimeter of the building with a plywood sheathed roof diaphragm. The gravity system has open web wood trusses that are supported by glulam beams. The glulam beams are supported by the precast tilt-up wall panels and interior steel pipe columns for support.

There is a covered play area in the northeast side of the building. Drawings were not available for this structure and it was not included in the review.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- There are no foundation ties connecting the strip footings to the precast tilt-up shear walls.
- The diaphragm is unblocked and spans more than 40 ft.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies

- Lightweight partitions are supported by the drop ceiling throughout the building.
- Drop ceilings are not braced.
- Lights not independently supported in the drop ceilings at some locations.

Note: The drop ceiling was being renovated during the site visit.

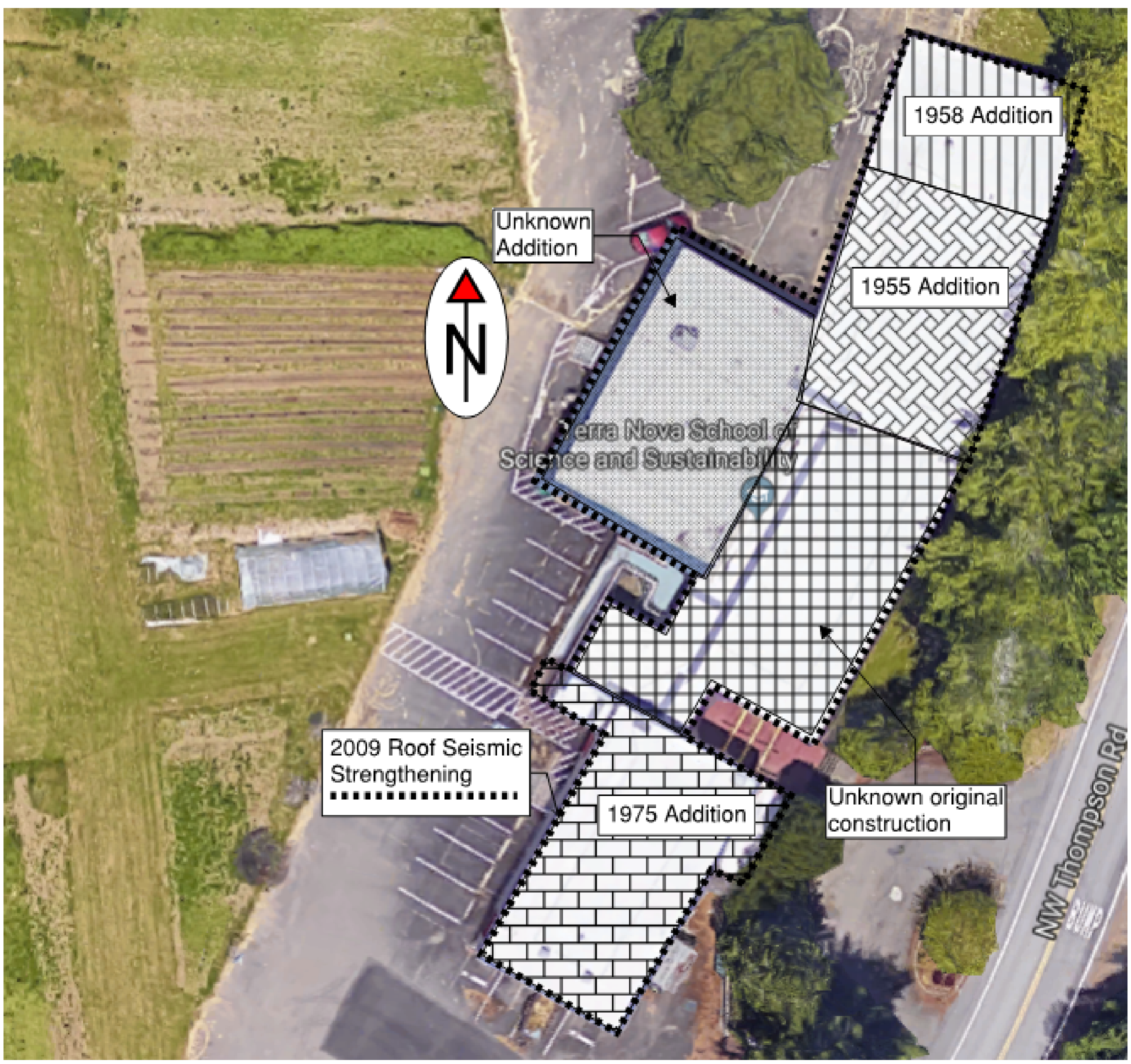
54: Terra Nova School of Science & Sustainability

Building Summary and Building Year Plan

The Terra Nova School of Science & Sustainability was constructed in an unknown year and has additions in 1955, 1958, and 1975, as well as an addition in an unknown year, and re-roofing in 2009. The 1955 and 1958 additions added three new classrooms and the 1975 addition added a gymnasium. During an unknown year addition, the open-air corridor on the 1955 and 1958 additions were enclosed.

The lateral force-resisting system consists of wood framed shear walls (W2) and reinforced masonry shear walls (RM1). The roof system was originally tongue and groove decking and shiplap, but plywood decking was added during the 2009 roof upgrade.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original building was observed to be similar to the 1955 and 1958 additions. These additions have strip footing foundations and a concrete slab-on-grade. The strip footings support wood shear walls. The shear walls are tied into the footings with steel anchors and attached to the roof diaphragm. There was a wall infill for the covered roof over the hallway, but drawings were not available during this review. It is assumed that the structure is a wood wall infill similar to the construction of the rest of the building.

The 1975 addition is constructed with a concrete slab-on-grade and strip footings. The lateral force-resisting system is constructed of wood shear walls along three sides of the addition and a reinforced masonry shear wall along the north wall. The roof was constructed using plywood sheathing. The roof framing bears on the reinforced masonry shear walls through a wood ledger and on the wood shear walls on a sill. There is a mechanical mezzanine that frames into wood shear walls on all sides in the northern side of the building.

The 2009 re-roofing added plywood sheathing over the shiplap decking in the original building, the 1955 addition, and the 1958 addition. The wood ledgers in the 1975 addition were retrofitted with tension ties so that the wood roof framing did not induce cross-grain bending for out-of-plane loading. The unknown year addition added plywood decking installed over the existing tongue and groove decking.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- The foundation elements are not tied together in the 1955 and 1958 addition. It is also assumed that the foundations are not tied together for the original building and the building addition from the unknown year.
- The wood shear wall detailing and locations are likely not adequate and require strengthening.
- Reinforcement ratio in the reinforced masonry shear walls are less than the allowable and likely require strengthening for both in-plane and out-of-plane forces.
- Plywood decking in the gym is unblocked and does not meet the criterion that all wood decking spanning more than 40 ft needs to be blocked.
- The roof diaphragm is not continuous at the gym addition, the 1955 addition, and the building addition from the unknown year.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies

- There is tall and narrow equipment throughout the building that is not anchored.

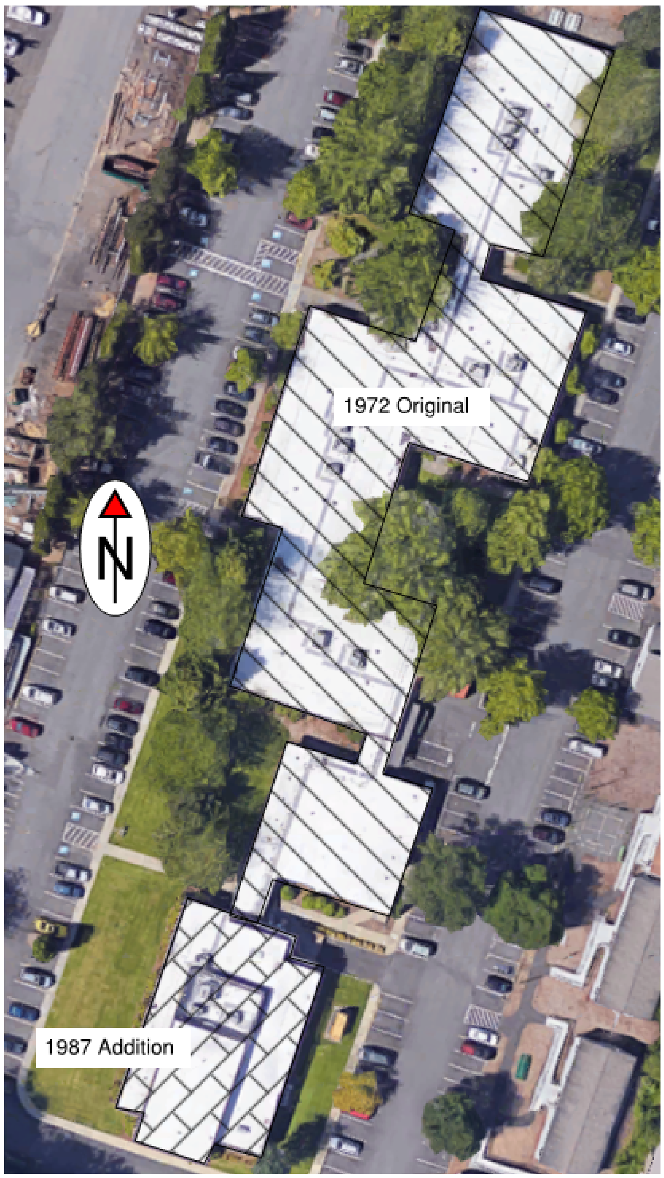
55: Administration Building

Building Summary and Building Year Plan

The Administration Building was constructed in 1972 with one addition in 1987.

The 1972 administration building is a single-story reinforced clay brick building (RM1) with a plywood sheathed diaphragm and reinforced clay brick shear walls. The 1987 addition is a wood framed building (W2) with a plywood sheathed diaphragm and plywood sheathed shear walls.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The main portion of the administration building was constructed in 1972. The roof of this single-story masonry structure (RM1) consists of plywood sheathing on TJL's on glulam beam girders. The roof is supported by reinforced clay brick perimeter bearing walls and interior steel columns. The first floor is a slab-on-grade. The foundation consists of continuous concrete walls at the building perimeter, and isolated concrete footings at the building interior. The building is laterally supported with plywood sheathed roof diaphragms and clay brick shear walls.

The attached south wing addition was constructed in 1987. The roof of this single-story wood structure (W2) consists of plywood on manufactured roof trusses upper roof and plywood on TJI lower roof. The roof is supported by wood stud bearing walls with brick veneer as well as reinforced clay brick bearing walls. The floor is post and beam construction. The addition is laterally supported with plywood sheathed roof diaphragms and plywood sheathing bearing walls.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Wall anchorage at reinforced masonry may be inadequate to resist out-of-plane wall loads at wall locations perpendicular to trusses (ASCE-41 Quick Check calculation required).
- Shear stress capacity of clay brick shear walls may be inadequate to resist lateral forces (ASCE-41 Quick Check calculation required).
- Continuous cross ties not present between diaphragm chords.
- Diaphragms likely require strengthening because of large spans that are unblocked.
- Inadequate wood ledger detail at clay brick walls in the addition. Connection at risk of failure during seismic event due to cross-grain bending.
- Shear stress capacity of plywood shear walls may be inadequate to resist lateral forces.

- Long window line below upper roofs at addition. Wood piers may be too short to sufficiently transfer lateral loads to lower roof.
- No seismic joint between the original main building and the south wing addition.
- Interior wood posts supporting the floor at the addition are not positively connected to the footing.
- No diaphragm reinforcement at the low roof openings for popup roofs.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Server room equipment braced to raised floor with tiles. Some equipment is not braced to floor tiles.
- Unbraced suspended ceilings.

56: Maintenance Building

Building Summary and Building Year Plan

The Maintenance Building was constructed pre-1971. Four other buildings on-site were constructed in 1978, 1987, 2002, and one unknown year.

The pre-1971 maintenance building is a single-story building (S2) with tension rod wall bracing, steel moment frames, and a bare metal deck diaphragm. The 1978 print shop is a single-story steel building (S2) with tension rod wall bracing and a bare metal deck diaphragm. The 2002 carpenter's shop is a single-story steel building (S2) with tension rod braced roof and an unknown lateral force-resisting system. The 1987 maintenance modular is a wood framed (W2) building. The pole barn is a wood framed building (W2).

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

Built prior to 1971, the maintenance shop is a single-story steel warehouse (S2). The roof is a steel deck supported on steel beams and plate girders. The plate girders are supported by tapered plate columns. The building is laterally braced with steel tension braces at the exterior walls in the long direction and steel moment frame (plate girders) in the short direction. The first floor is a slab-on-grade. Foundation elements are unknown.

In 1971, a wood mezzanine structure was added which consisted of wood tongue and groove deck on glulam joists and steel beam girders. This mezzanine appears to be self-supported vertically and laterally by steel tube columns.

The 1978 print shop is a single-story steel warehouse (S2). The roof is a steel deck supported on steel beams and plate girders. The plate girders are supported tapered plate columns. The building is laterally braced with steel tension braces at the exterior walls in the long direction, and steel moment frame (plate girders) in the short direction. The first floor is a slab-on-grade. Foundation elements consists of isolated concrete footings and continuous concrete footings at the building perimeter. The print shop also contains two wood framed mezzanines. The mezzanine floor is plywood sheathed floor on 2x joists and glulam beams and is supported by steel tube columns. It appears the mezzanine is laterally supported by the steel columns only.

The 2002 carpenter's shop consists of unknown decking on 2x wood joists supported by an open-web steel lattice moment frame (S2). The building diaphragm consists of a steel rod bracing. The building is laterally braced with steel tension braces at the exterior walls in the long direction and steel lattice moment frame in the short direction.

Built in 1987, the maintenance modular building is a simple single-story wood framed structure (W2). The roof consists of plywood on manufactured wood roof truss on wood stud bearing walls. The first floor is wood post and beam construction. The building is laterally supported by the plywood sheathed roof and plywood sheathed perimeter walls.

The wood pole barn is constructed with wood trusses supported by 6x wood posts. The floor is a slab-on-grade. Foundations are unknown.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- Tension rod braces in the maintenance building, print shop, and carpenter's shop may be inadequate to resist lateral loads.

- Moment frames in the maintenance building, print shop, and carpenter's shop may be inadequate to resist lateral loads.
- Pole barns are typically structurally inadequate to resist lateral loads. More detailed survey and analysis is recommended.
- The maintenance modular floor is likely not attached to the perimeter foundation due to lack of connection at the sheathing to the sill plate. There was no crawl space access to assess the condition further.
- No indication of hold-downs in maintenance modular drawings to resist overturning forces.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Unbraced hollow CMU partition walls in welding area of maintenance shop.
- Unbraced light fixtures in drop ceiling of maintenance modular.
- Light fixtures in carpentry shop is unbraced and is at risk to damaging vacuum hoses.
- 8 ft tall wood shelves in carpentry shop are not anchored to the floor.
- Unbraced heater unit in carpentry shop.
- Unanchored steel racks in pole barn throughout.

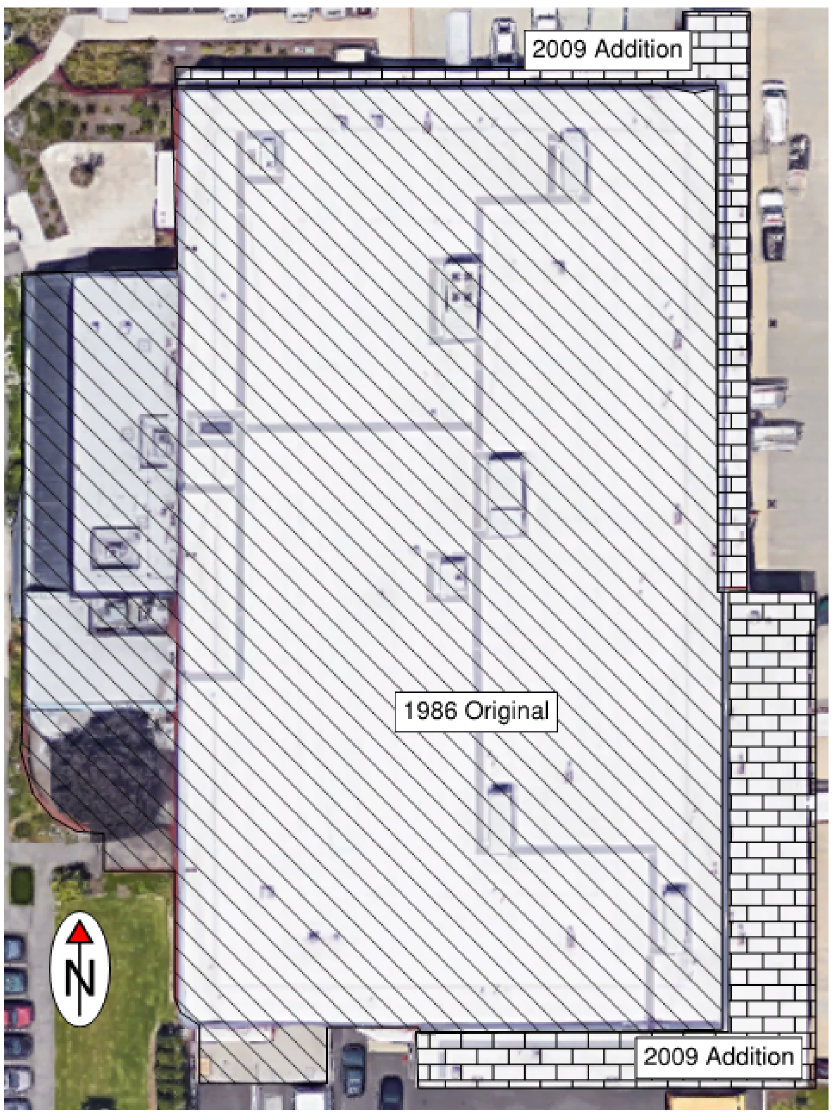
57: Transportation Main

Building Summary and Building Year Plan

The Transportation Main building was constructed in 1986, with several additions in 2009.

The original building is a single-story building (RM1/S2) with steel braced frames, CMU shear walls, and bare metal deck diaphragms. The 2009 mezzanine addition is a single-story wood structure (W2) with a plywood floor diaphragm and plywood sheathed shear walls. The 2009 shop addition is a single-story steel structure (S2/RM1) with steel moment frames, CMU shear walls, and a bare metal deck roof diaphragm.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The Transportation Main building (or Transportation & Support Center, TSC) was constructed in 1986. It is a single-story steel warehouse (S2) with office spaces. The roof is constructed with plywood sheathing on open web wood joists. The joists are supported by steel columns. The foundation is a slab-on-grade with isolated concrete footings beneath the columns. The building is laterally supported by plywood deck diaphragms which are connected to perimeter steel braces.

In 2009, a major renovation occurred which included: office mezzanine addition, shop mezzanine, moment frame additions at shop bays, and an attached south storage addition. The office mezzanine addition consists of a plywood sheathed floor on TJI joists. The floor is supported by wood stud walls on continuous concrete footings. The lateral force-resisting system is composed of a plywood diaphragm connected to plywood sheathed wood walls. These walls are supported by continuous concrete footings. The shop mezzanine is a concrete on metal deck supported by steel wide flange beams and reinforced CMU bearing walls. The CMU walls are supported by continuous concrete footings. Steel moment frames were added to the north and east elevations to widen the framing bays. These moment frames are anchored to concrete spread footings. The south storage addition consists of reinforced CMU construction (RM1). The roof is bare metal deck. The deck serves as the diaphragm and the CMU walls serve as shear walls to support the addition laterally. The ground floor is a slab-on grade.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

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Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- CMU wall anchorage may be inadequate to resist out-of-plane wall loads (ASCE-41 Quick Check calculation required).
- Axial strength in braced frame braces and columns may be inadequate to resist lateral forces.

- Connections at ends of braced frame members are likely inadequate due to (2) bolt connection.
- Braced frame members do not meet section compactness requirements of AISC 360.
- Braced frame members may not meet slenderness requirements.
- No CMU reinforcement schedule found. CMU walls may be under-reinforced.
- Wall anchorage to roof may be insufficient to develop lateral forces at connection.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Unanchored tall and narrow shelves in warehouse 152.
- Unanchored mechanical unit in weld room 152.
- Unbraced half-height CMU wall in shop 163.
- Gas lines throughout are not braced.
- Unbraced fire lines in records room and tire storage room.
- Unbraced water pipes below roof in warehouse 152.

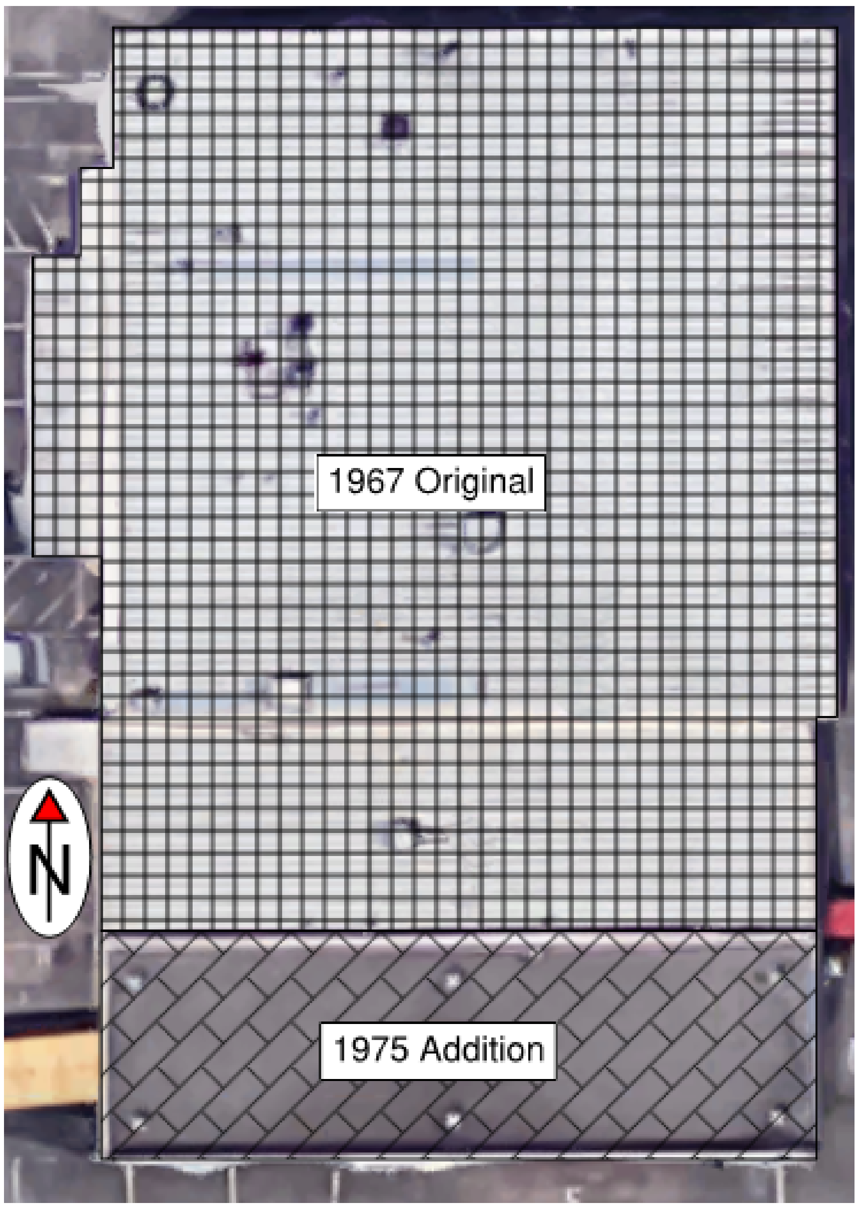
58: Transportation Allen

Building Summary and Building Year Plan

The Transportation Allen Building was constructed in 1967 with an addition in 1975.

The 1967 Transportation Allen building is a single-story masonry building (RM1) with a corrugated metal roof diaphragm and CMU shear walls.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The Transportation Allen building was built in 1967 and functions primarily as a maintenance facility. The original building is a single-story masonry building (RM1). The roof is a corrugated metal roof supported by glulam beams and CMU pilasters. The first floor is slab-on-grade. The foundation is unknown. The building is laterally braced by a corrugated metal deck diaphragm and CMU shear walls. There is a mezzanine driver's lounge on the west side of the building. The construction of this lounge could not be determined in the field due to hard ceilings below. There is a wood mezzanine in the shop constructed with 2x joists and supported by wood posts.

A shop addition was added to the south in 1975. The roof and wall construction is similar to that of the original building. As-built drawings for the addition indicate reinforced CMU and continuous concrete foundation at the perimeter of the addition.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

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Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- CMU walls in original building may not be secured to foundation.
- Lack of redundancy due to no shear wall line on east elevation.
- Inadequate reinforcing (<0.002) and no indication of vertical bar reinforcing because original building drawings are incomplete.
- It is unclear how the metal deck attaches to the CMU walls in the original building due to heavy insulation obstruction.
- Shear capacity in CMU shear walls may be inadequate to resist lateral loads at original building and addition (ASCE-41 Quick Check calculation required).
- No continuous cross ties at diaphragm at original building and addition.
- No out-of-plane anchors at exterior CMU walls at addition.

- Blocking between top of CMU wall and roof at addition are prone to cross-grain bending.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

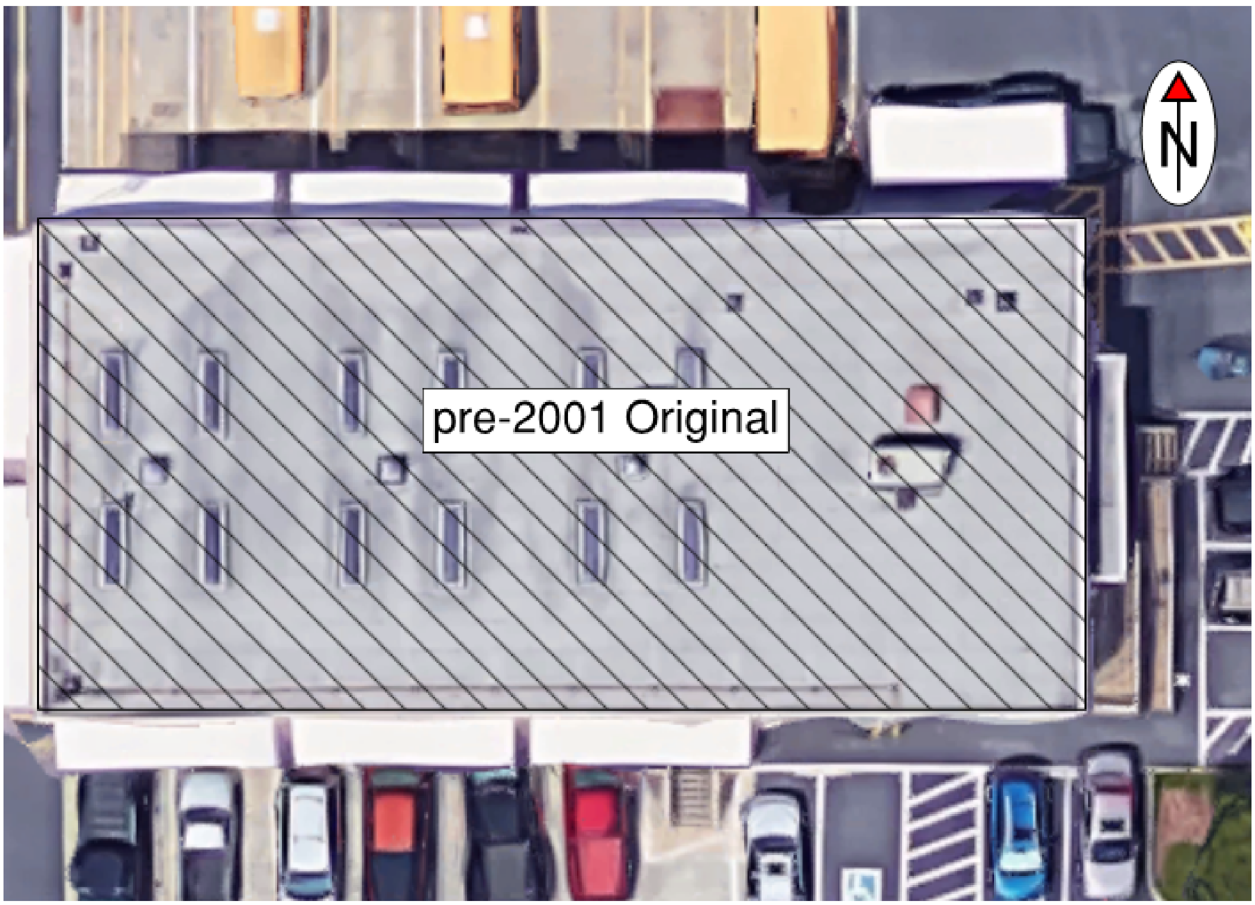
- Unanchored tall and narrow shelves in tire room.
- Timber curb at rooftop AC unit not secured to the roof.

59: Transportation 5th St. North

Building Summary and Building Year Plan

The Transportation 5th St. North building was constructed pre-2001 and is a single-story concrete building (C2a) with a plywood sheathed roof diaphragm and concrete shear walls.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level



Building Description (separated by construction phases)

The original construction year of the Transportation 5th St. North building is unknown. The building is a single-story warehouse structure with a small array of attached offices. The roof consists of plywood on open web wood joints, which are supported by concrete exterior walls that are likely reinforced cast-in-place construction (C2a). The foundation consists of elevated slab-on-grade with concrete perimeter stem walls on continuous footings. The building is laterally supported by the plywood sheathed diaphragm and perimeter concrete shear walls.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- No as-built drawings of the original building available.
- Load path may be incomplete.
- Wall anchorage may be inadequate to resist out-of-plane lateral loads (ASCE-41 Quick Check calculation required).
- Warehouse mezzanine with mechanical equipment may not be anchored to the main structure.
- Wood ledgers are at risk of failure during seismic event due to cross-grain bending.
- Shear stress capacity of concrete shear walls may be inadequate to resist lateral loads (ASCE-41 Quick Check calculation required).
- Concrete shear walls may be under-reinforced to resist lateral loads.
- No continuous cross ties between diaphragm chords.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Unanchored storage racks greater than 6 ft throughout.
- No access to the roof.

60: Transportation 5th St. South

Building Summary and Building Year Plan

The Transportation 5th St. South building was constructed in 1965 and is a single-story reinforced masonry building (RM1) with a metal deck diaphragm and CMU shear walls.

Building Risk Category III
ASCE 41-13 Damage Control Performance Level

Building Description (separated by construction phases)

The Transportation 5th St. South building was constructed in 1965 as a print shop. This is a single-story structure that encloses a warehouse space and several offices. The roof consists of metal deck on steel wide flange beams. These beams are supported by steel girders. These girders are supported by interior steel columns and exterior CMU pilasters. The exterior of the building is constructed with reinforced CMU walls (RM1). The columns are supported by concrete spread footings, and the CMU walls are supported by continuous concrete footings. There are many CMU partition walls in the office space that extende to the roof. The building is laterally supported with the metal roof deck diaphragm and exterior shear CMU shear walls.

Seismic Assessment

The Tier 1 checklists from ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*, were used as a guide for the seismic assessments of all Beaverton School District Campuses. These checklists assist in identifying seismic deficiencies of a structure. A full Tier 1 evaluation was not completed for each school as this assessment is intended to be a higher-level review. Checklists for each building are included in the Appendix of this report.

Damage Control is the performance level target for Beaverton School District which is between Life Safety and Immediate Occupancy. The intent for the Damage Control Performance Level is to limit damage to the building beyond what would be expected for the Life Safety Performance Level. Damage Control is the recommended performance level for school buildings.

Since there are not specific checklists for the Damage Control Performance Level, ASCE 41-13 uses the Life Safety Checklists as a baseline with a variance on certain criteria through the checklists.

Summary of Seismic Structural Deficiencies

Below is a summarized list of remaining seismic deficiencies found in the building. Some of these items are localized to certain areas as noted.

- CMU walls may be inadequately anchored to the roof deck.
- Shear stress capacity of CMU shear wall may be inadequate to resist lateral loads (ASCE-41 Quick Check calculation required).
- Low amount of reinforcement in CMU may be inadequate to resist lateral loads (for in-plane and out-of-plane).
- No apparent connection between metal deck and CMU wall in break room, although view was obstructed by continuous fire tape.
- No positive connection between CMU and parallel deck in the warehouse.
- Weak connection (¼ inch screws?) to CMU walls in boiler room.
- Geologic site hazards such as Liquefaction and Surface Fault Rupture are unknown, but are likely not a deficiency for this site.

Summary of Seismic Nonstructural Deficiencies (included in cost per square foot above)

- Unbraced low hanging lights in the warehouse.
- Unbraced small water pipes in the warehouse.
- Unbraced air handling unit suspended from roof by steel trapeze in the warehouse.