May 8, 2017

Mr. Henry Fitzgibbon
Soderstrom Architects
1200 NW Naito Parkway
Suite 410
Portland, OR 97209

RE: Sutherlin School District Facilities Assessment

catena project number: 2017047.00

Henry:

As part of the facilities condition assessments Soderstrom Architects is performing for the Sutherlin School District, you asked us to perform structural condition assessments of the schools and facilities included in this report. Our evaluation included a review of available architectural and structural design drawings, and a review of any available *FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards* report cards completed by others in 2006 on behalf of the Oregon Department of Geology and Mineral Industry (DOGAMI) Statewide Seismic Needs Assessment. On April 20, 2017, we conducted a field reconnaissance with Mr. Rick Holder of the District to observe the general physical status of the building structures and to corroborate the information shown on the original design drawings and FEMA 154 report cards. Based upon the general configuration of the buildings observed during our field reconnaissance, it is our opinion that those as-constructed buildings observed are likely in general conformance with the information shown in the original drawings provided to us. Building structural components that were concealed within architectural finishes were not observed.

We provide below an assessment of structural deficiencies that should be addressed or would need to be addressed in the context of a remodel, the scope of which is yet to be defined. Except as noted, we observed very little distress to structural components; therefore, much of our findings that follow is related to seismic resistance.

Sutherlin School District Administration Building

Building Structure Description:

The Sutherlin School District Administration Building is located at 531 E Central Avenue in Sutherlin, Oregon.

This two-story building, originally constructed 2001, consists of a shallow reinforced concrete foundation system, a reinforced concrete slab on grade at the ground floor, perimeter CMU bearing walls with punched openings and interior wood columns, a second floor of wood structural panel sheathing atop pre-engineered wood i-joists, and a gabled roof of wood structural panel sheathing atop 2x wood rafters and glue-laminated timber hip beams.

Documentation Review:

We reviewed the following materials documenting the building structure:

- Drawing sheets A-1 through A-9, titled *A New Administration Building for Sutherlin School District*, by Paul L. Bentley, Architect, AIA, PC, dated October 20, 2000.

A FEMA 154 report card for the Administration Building was not found within the DOGAMI database.

Observed or Potential Structural Deficiencies:

No visible signs of structural damage or distress were observed during our field reconnaissance.

Given its date of construction, the Administration Building incorporates modern seismic design and detailing practices. Therefore, in accordance with *ASCE/SEI 41-13 Seismic Evaluation and Retrofit of Existing Buildings*, the building is classified as a benchmark building, presumed to provide acceptable life-safety protection to its occupants during a major seismic event. Further seismic evaluation of the Administration Building is unwarranted.

Sutherlin Middle School

Building Structure Description:

There are five primary building structures on the Sutherlin Middle School campus. The school is located at 649 E 4th Avenue in Sutherlin, Oregon.

The single-story South Administration Wing (designated as Building A and B on your plans), South Classroom Wing (designated as Building C on your plans), and North Classroom Wing (designated as Buildings D and E on your plans) were originally built in 1961. Construction consists of a shallow reinforced concrete foundation system supporting reinforced CMU bearing walls, structural steel pipe columns and a prefabricated wood-framed roof assembly. The prefabricated roof assembly consists of plywood sheathing atop 2x purlins and an integrated 1x bottom flange, and rests atop glue-laminated timber beams along the roof ridge and exterior colonnade. In 1968, a single classroom was added to both the North and South Classroom Wings by extending each building to the east. And, sometime between 1974 and 1998, a renovation and addition to the South Administration Wing removed walls and added the bathrooms to the north and the student center to the south. Architectural or structural drawings of these additions and renovations were not available for our review; however, construction appears to match that of the original buildings.

The Gymnasium (designated as Building F on your plans) was constructed in 1971 and consists of a shallow reinforced concrete foundation system, a reinforced concrete slab on grade, and perimeter and interior partial-height reinforced CMU walls transitioning to wood-framed walls up to the underside of roof. Roof construction consists of plywood sheathing, 2x wood purlins, and long-span glue-laminated timber bow-string trusses with arched top chords. Structural steel wide-flange columns support the roof trusses. There is a plywood-

sheathed wood-framed mezzanine on the south side of the Gymnasium below which are locker rooms.

In 1973 and 1974, two additional classrooms were added to the southeast of campus (designated as Building G on your plans). Construction of this structurally-independent South Classroom Addition consists of a shallow reinforced concrete foundation system, reinforced CMU bearing walls, and structural steel pipe columns supporting a roof assembly of plywood sheathing, 2x purlins, and glue-laminated timber beams along the roof ridge and exterior colonnade.

The single-story Administration Building (designated as Building J on your plans) was built in 2006. This single-story modular structure consists of a shallow reinforced concrete foundation system supporting a wood-framed and plywood-sheathed ground floor and roof. Wood-framed walls are sheathed with oriented strand-board panels.

A breezeway connects the North Classroom Wing to the South Classroom Wing. Construction of the breezeway consists of periodic steel pipe columns supporting a wood-framed roof.

Other small buildings, portables, sheds, or accessory structures on the Sutherlin Middle School campus not specifically mentioned above were not reviewed and are outside the scope of this assessment.

Documentation Review:

We reviewed the following materials documenting the building structure:

- Drawing sheets 1 through 8, titled *Sutherlin Junior High School*, by Payne & Struble Architects, AIA, dated July 13, 1961.
- Drawing sheets 1 through 7, titled *Sutherlin Junior High School, Gymnasium Bldg.*, by Robert F. Fisher, Architect, AIA, dated September 30, 1970.
- Drawing sheets 1 through 4, titled *Additions: Junior High School Classroom*, by Robert F. Fisher, Architect, AIA, PC, dated February 28, 1974.
- Drawing sheet A-1 titled *A Facility Study for Sutherlin High & Middle School*, by Paul L. Bentley, Architect, AIA, dated February 20, 1998.
- Drawing sheets A1.2 through A3.2, titled *Sutherlin Middle School Expansion Project*, by Rex Price Architecture, dated August 24, 2006.
- *FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards* report card completed in 2006 as part of the Oregon Department of Geology and Mineral Industry (DOGAMI) Statewide Seismic Needs Assessment.

Note that the DOGAMI Statewide Needs Assessment occurred prior to the construction of the Administration Building; therefore, a FEMA 154 report card of that building is not available.

Observed or Potential Structural Deficiencies:

No visible signs of structural damage or distress were observed to any of the buildings on the Sutherlin Middle School campus during our field reconnaissance.

Since the original construction of the campus, the knowledge of the seismicity in the area has increased significantly and there has been considerable advancement in code-mandated seismic detailing. Therefore, seismic vulnerabilities are anticipated.

Through the FEMA 154 efforts completed on behalf of DOGAMI in 2006, primary building components were evaluated and assigned RVS scores. The results are as follows:

Building	RVS Score	Collapse Probability
South Classroom Wing	2.3	0.5%
North Classroom Wing	2.3	0.5%
South Administration Wing	2.3	0.5%
Gymnasium	1.3	5.0%
South Classroom Addition	2.8	0.2%

The collapse probabilities presented above represent the chance of structural collapse during a "maximum considered earthquake" expected to recur every 2,500 years. FEMA recommends buildings with final RVS scores of 2 or less be investigated further using the evaluation procedures of ASCE/SEI 41-13, which can more accurately measure both Life Safety and Collapse Prevention seismic performance objectives. A more thorough evaluation in accordance with ASCE/SEI 41-13 is beyond the scope of this facilities conditions assessment, and to the best of our knowledge has not been completed. Please note that FEMA 154 scoring is by nature cursory and inexact, is prone to error should the evaluator be inexperienced, and can therefore at times lead to incorrect conclusions regarding seismic risk. In the case of Sutherlin Middle School, we believe the North Classroom Wing and South Classroom Wing may have a higher risk of potential collapse than what is indicated with their FEMA 154 RVS scores.

Some potential seismic-related structural deficiencies were identified through our cursory review of the original drawings and our field reconnaissance. These include, but are not necessarily limited to, the following:

- The prevalent use of open-front construction with windows along the south side of the North Classroom Wing, the north side of the South Classroom Wing, and the west side of the South Classroom Addition may result in inadequate seismic resistance in the long direction of these buildings.
- The presence of full-length ridge vents along the North Classroom Wing, the South Classroom Wing, and the South Classroom Addition appear to compromise the ability of the roof diaphragms to effectively transfer seismic loads to the CMU walls below.
- The partial-height CMU walls at the Gymnasium appear to have insufficient out-of-plane seismic resistance given the minimal development of their vertical reinforcing into the footings that support them, and the minimal size of the footings themselves. These

partial-height CMU walls support the wood-framed walls above, and an instability may result from out-of-plane seismic forces.

- Given its high length-to-width aspect ratio, the breezeway roof connecting the North Classroom Wing to the South Classroom Wing may have insufficient diaphragm shear capacity when resisting seismic forces in the transverse (east-west) direction.

For buildings with this type of construction and vintage, the following seismic deficiencies may also be found to exist with a more thorough evaluation:

- Missing vertical lateral elements, e.g., an open front construction with all windows and limited or no shear walls.
- Inadequate anchorage of the tops of CMU walls to the roof to transfer out-of-plane forces.
- Inadequate connection of the roofs and/or mezzanines to the CMU walls to transfer in-plane forces.
- Inadequate CMU reinforcing and/or inadequate lap splices between reinforcing bars.
- Inadequate strength and stiffness of roof and floor diaphragms.
- Diaphragm discontinuities, e.g., steps in roof elevations, reentrant (inside) corners, etc.
- Overstressed wood stud shear walls, e.g. walls that are too short and/or don't have structural sheathing.
- Unsheathed and/or inadequately anchored wood stud cripple walls.

The seismic deficiencies noted above could put portions of the buildings at risk of partial collapse during a major seismic event and thereby endanger the safety of the buildings' occupants. A more comprehensive structural evaluation – like that of an ASCE/SEI 41-13 evaluation – is necessary to fully identify all potential seismic deficiencies, quantify the risks associated with them, and determine what retrofit measures may be employed to mitigate those risks.

Sutherlin High School

Building Structure Description:

There are six primary building structures on the Sutherlin High School campus. The school is located at 500 E 4th Avenue in Sutherlin, Oregon.

The South Classroom Building (designated as Building A on your plans) is a single-story building with a shallow reinforced concrete foundation system, a reinforced concrete slab on grade, and a wood-framed superstructure with 2x tongue & groove wood roof decking and glue-laminated timber roof beams. A central corridor divides the building. The portion of the building to the south of the corridor was built in stages between 1968 and 1971. The portion to the north of the corridor was constructed in 1974 just prior to a fire that destroyed the original Sutherlin High School building to the east.

The Gymnasium (designated as Building C on your plans) was built in 1975 atop the eastern-most portion of the original Sutherlin High School footprint mentioned above. This building consists of a shallow reinforced concrete foundation system, a reinforced concrete slab on grade, perimeter partial-height reinforced CMU walls transitioning to wood-framed walls above, and interior wood-framed bearing walls. The stepped roof consists of 2" cement-fiber decking panels between long-span pre-engineered open web wood trusses at the higher gymnasium area, and plywood sheathing atop pre-engineered wood i-joists at the lower areas to the south, west, and north. A breezeway canopy extends from the south and west sides of the Gymnasium building just above the top of exterior CMU wall; construction consists of 2x tongue & groove decking spanning to a timber beams and posts along the canopy's outboard edge.

The single-story Activity Center Building (designated as Building B on your plans), was built in 1976 atop the western-most footprint of the original Sutherlin High School Building mentioned above. Based on observations made during our field reconnaissance, construction of this building appears to approximately match that of the adjacent Gymnasium Building, including partial-height CMU exterior walls transitioning to wood-framed walls above. It appears that the roof structure may incorporate glue-laminated timber beams, as small integrated canopies above windows on the south and east sides of the building are framed large glue-laminated beams that appear to cantilever from the roof plane. There is a slight step in roof elevation coinciding with the transition between the Library and open Activities areas. Small timber-framed breezeway roofs were constructed at the east and west entries to the building and along the east side, and connect the Activity Center Building to the Gymnasium and South Classroom Wing. Sometime between 2000 and 2003, a light wood-framed and corrugated plexiglass panel roof was added between the Activity Center Building and the Gymnasium as a sunshade over a picnic area. This sunshade is supported by the Activity Center breezeway and the South Classroom Building roof. Available drawings of the Activity Center Building and breezeway roofs were limited to a single architectural ground floor plan. We suspect the picnic sunshade was constructed without drawings.

The single-story Science Building (designated as Building D on your plans) was constructed in 1976 just to the north of the South Classroom Building. This building consists of a shallow reinforced concrete foundation system, a reinforced concrete slab on grade, perimeter partial-height reinforced CMU walls transitioning to wood-framed walls above, and interior wood-framed bearing walls. The roof consists of plywood sheathing atop pre-engineered wood i-joists that cantilever beyond the building face to provide cover for the sidewalk surrounding the building.

The single-story Vocational Shop Building (designated as Building E on your plans) was constructed sometime prior to 1974, perhaps as part of the original high school. There are mezzanines on the north and south sides of the building footprint. Based on observations made during our field reconnaissance, this building consists of partial-height exterior CMU walls transitioning to wood-framed walls along the east and west sides of the building, partial-height exterior CMU walls transitioning to wood posts at an elevation just above the mezzanine along the north side of the building, and full-height exterior CMU walls along the south side of the building. The roof consists of tongue & groove wood decking, wood purlins and long-span timber beams. The purlins are supported off the sides of the beams with continuous wood ledgers. The mezzanines are wood-framed. A small wood-framed shed is

connected to the west side of the building, and there is a relatively modern pre-manufactured metal roof structure adjacent to the northwest corner of the building. Drawings for the Vocational Shop Building were unavailable for our review.

The single-story Metal Shop Building (designated as Building F on your plans) was constructed sometime prior to 1974, perhaps as part of the original high school. Based on observations made during our field reconnaissance, this building consists of exterior and interior timber posts supporting glue-laminated timber roof beams. 2x wood purlins span between the roof beams. Full-height CMU walls clad all four sides of the building and are located just inboard of the exterior wood posts on the north and south sides. Drawings for the Metal Building were unavailable for our review.

There are four small ancillary structures at the far west side of the campus. A single-story single-classroom building at the corner of NE 4th Avenue and Umatilla Street (designated as Building G on your plans) is constructed of perimeter CMU walls and a wood-framed roof. While no drawings were available, we believe this single-classroom building was constructed prior to 1974, perhaps as part of the original high school. There are three modular buildings (designated as Buildings H, J, and K on your plans) at the far west side of the campus. We believe these single-story structures were constructed sometime between 1988 and 1994. Construction of these modular buildings consist of shallow reinforced concrete footings, a wood-framed ground floor over a crawl space, perimeter wood-framed walls, and a wood-framed gabled roof.

Other small buildings, portables, sheds, or accessory structures on the Sutherlin High School campus not specifically mentioned above were not reviewed and are outside the scope of this assessment.

Documentation Review:

We reviewed the following materials documenting the building structure:

- Drawing sheets 8 through 11, titled *Additions: High School Classroom*, by Architect Robert F. Fisher, AIA, dated February 28, 1974.
- Drawing sheet 8, titled *Sutherlin High School Buildings*, by Architect Robert F. Fisher, AIA, dated November 4, 1974.
- Drawing sheets 1 through 16, titled *Sutherlin High School Gym – Music Building*, by Architect Robert F. Fisher, AIA, dated March 21, 1975.
- Drawing sheet 3, titled *H.S. Library – Resource Center – Activities – Office Bldg.*, by Architect Robert F. Fisher, AIA, dated November 6, 1975.
- Drawing sheets 1, 2 and 4, titled *Science – Homemaking – Classroom Building*, by Architect Robert F. Fisher, AIA, dated May 18, May 27, and June 18, 1976, respectively.
- *FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards* report card completed in 2006 as part of the Oregon Department of Geology and Mineral Industry (DOGAMI) Statewide Seismic Needs Assessment.

FEMA 154 report cards were not completed as part of the 2006 DOGAMI effort for the Metal Shop Building, the Vocational Shop Building, or any of the four ancillary buildings mentioned above.

Observed or Potential Structural Deficiencies:

White efflorescence was observed on the inside face of the east wall of the Gymnasium, primarily concentrated at pilaster locations. Efflorescence occurs when moisture dissolves alkali sulfates within masonry, migrates to an exposed face through natural pores, then dries to leave the visible salts. The presence of efflorescence is generally not indicative of a structural issue; however, left unchecked, ongoing moisture within masonry walls may degrade the block, grout, and/or mortar, and may lead to corrosion of the reinforcing. Therefore, we recommend that continual maintenance of paints, sealers and/or flashing occur to prevent rain from penetrating through the exterior face of CMU.

Dry rot damage was observed at base of some of the timber posts supporting the canopy on the south side of the Gymnasium. Dry rot damage was also observed at several of the cantilevered glue-laminated beam ends at the Activity Center Building and the Metal Shop Building. Unprotected ends of timber members are particularly susceptible to ambient moisture and dry rot, where water has a tendency migrate through capillary action into the members.

Through the FEMA 154 efforts completed on behalf of DOGAMI in 2006, primary building components were evaluated and assigned RVS scores. The results are as follows:

Building	RVS Score	Collapse Probability
South Classroom Building	3.8	< 0.1%
Gymnasium	1.8	1.6%
Activity Center Building	1.3	5.0%
Science Building	2.8	0.2%
Metal Shop Building	n/a	Unknown
Vocational Shop Building	n/a	Unknown

The collapse probabilities presented above represent the chance of structural collapse during a "maximum considered earthquake" expected to recur every 2,500 years. FEMA recommends buildings with final RVS scores of 2 or less be investigated further using the evaluation procedures of ASCE/SEI 41-13, which can more accurately measure both Life Safety and Collapse Prevention seismic performance objectives. A more thorough evaluation in accordance with ASCE/SEI 41-13 is beyond the scope of this facilities conditions assessment, and to the best of our knowledge has not been completed. Please note that FEMA 154 scoring is by nature cursory and inexact, is prone to error should the evaluator be inexperienced, and can therefore at times lead to incorrect conclusions regarding seismic risk. In the case of Sutherlin High School, we believe the Science Building may have a higher risk of potential collapse than what is indicated with its FEMA 154 RVS score.

Some potential seismic-related structural deficiencies were identified through our cursory review of the original drawings and our field reconnaissance. These include, but are not necessarily limited to, the following:

- At the South Classroom Building, the 2x wood roof decking provide very little in-plane shear resistance without supplemental wood structural panel sheathing overlay.
- At the South Classroom Building, where exterior windows extend up both sides of the cantilevered glue-laminated roof beams, these beams may be susceptible to rolling off their support posts during a major earthquake.
- The partial-height CMU walls at the Gymnasium, Activity Center Building, Science Building, and Vocational Shop Building appear to have insufficient out-of-plane seismic resistance given the minimal size of the footings that support them. These partial-height CMU walls support the wood-framed walls above, and an instability may result from out-of-plane seismic forces.
- At the Gymnasium, none of the interior or exterior wood-framed walls appear to have plywood sheathing secured directly to the wood studs. The outside faces of exterior wood-framed walls are sheathed with aluminum-faced plywood siding, but installed over gypsum wallboard. Therefore, there appears to be very little in-plane seismic resistance to adequately support the roofs of the Gymnasium building during a major earthquake.
- At the Science Building, none of the interior or exterior wood-framed walls appear to have plywood sheathing secured directly to the wood studs. The outside faces of exterior wood-framed walls are sheathed with aluminum-faced plywood siding, but installed over gypsum wallboard. Therefore, there appears to be very little in-plane seismic resistance to adequately support the roof of the Science Building during a major earthquake.
- The prevalent use of open-front construction with windows along the north side of the Vocational Shop Building may result in inadequate seismic resistance in the transverse direction of the building.
- The cement fiber panels at the high roof of the Gymnasium provide only limited (and perhaps insufficient) in-plane shear resistance.
- There appears to be inadequate seismic bracing of the sunshade between the Activity Center Building and the South Classroom Building.

For buildings with this type of construction and vintage, the following seismic deficiencies may also be found to exist with a more thorough evaluation:

- A lateral system that does not continue all the way from the roof to the foundation (discontinuous load path).
- Mezzanines (partial floors) that have an incomplete lateral system, e.g., shear walls do not occur on all four sides of the mezzanine.

- Inadequate anchorage of the tops of CMU walls to the roof to transfer out-of-plane forces.
- Inadequate connection of the roofs and/or mezzanines to the CMU walls to transfer in-plane forces.
- Inadequate CMU reinforcing and/or inadequate lap splices between reinforcing bars.
- Inadequate strength and stiffness of roof and floor diaphragms.
- Diaphragm discontinuities, e.g., steps in roof elevations, reentrant (inside) corners, etc.
- Overstressed wood stud shear walls, e.g. walls that are too short and/or don't have structural sheathing.
- Unsheathed and/or inadequately anchored wood stud cripple walls.
- Unbraced unreinforced masonry (brick) chimneys.
- Canopies with no apparent lateral system.

The seismic deficiencies noted above could put portions of the buildings at risk of partial collapse during a major seismic event and thereby endanger the safety of the buildings' occupants. A more comprehensive structural evaluation – like that of an ASCE/SEI 41-13 evaluation – is necessary to fully identify all potential seismic deficiencies, quantify the risks associated with them, and determine what retrofit measures may be employed to mitigate those risks.

East Primary School

Building Structure Description:

There are two primary building structures on the East Primary School campus. The school is located at 323 E 3rd Avenue in Sutherlin, Oregon.

The two-story Cafeteria Building (designated as Building B in your plans) was originally constructed in 1910. Based upon observations made during our field reconnaissance, the Lower Level consists of perimeter concrete walls and interior wood-framed walls supporting a wood-framed floor to the Main Level cafeteria above. Exterior grade slopes down from north to south; therefore, the lower level is below grade on the north side of the building. Construction above the Main Level consists of timber-framed post-and-beam construction with exterior wood-framed walls at both the cafeteria and at the smaller single-story kitchen to the north. There is a step in the elevation between the higher cafeteria roof and the lower kitchen roof. We assume that both the cafeteria roof and kitchen roof incorporate wood purlins and/or tongue & groove decking between the primary beams. Given the building vintage, the roofs would only incorporate wood structural panel sheathing if it was added after the original construction. The exterior walls around the cafeteria are canted outward from the building at their base, creating an offset just above the perimeter concrete walls below. A small self-supported wood-framed canopy covers an outdoor vehicle delivery zone just to the west of the kitchen portion of the building. Drawings for the Cafeteria

Building were unavailable for our review. While the addition of the Main Building in 1999 (see below) presumably would have afforded such an opportunity, we found no evidence of any seismic rehabilitation measures to the Cafeteria Building.

The two-story Main Building (designated as Building A in your plans) was constructed in 1999 atop the original East Elementary School footprint, just east of the Cafeteria Building. A seismic joint separates the Main Building from the Cafeteria Building. Due to the grade elevation fall from the north to south sides of the school property, the north classroom and music wings of the building are single-story, while the south classroom and administrative wings are two-story. Based observations made during our field reconnaissance and from our review of available original mechanical, electrical and plumbing drawings, it appears that construction consists of a shallow concrete foundation system, concrete slabs on grade, interior and perimeter wood-framed walls, wood structural panel sheathing atop pre-engineered wood i-joists at elevated floors, and either gang-nailed wood roof trusses or pre-engineered wood i-joists at the ceiling/attic with light wood-framed roof overbuild to form gables. A CMU wainscot veneer surrounds the perimeter of the north classroom and music wings, and extends up to the Main Level in most locations of the south classroom and administrative wings. Horizontal wood siding is used above the CMU veneer. Architectural and structural drawings of the Main Building were unavailable for our review.

Other small buildings, portables, sheds or accessory structures on the East Primary School campus not specifically mentioned above were not reviewed and are outside the scope of this assessment.

Documentation Review:

We reviewed the following materials documenting the building structure:

- Drawing sheet 1, titled *East Elementary School Addition*, by Architect Robert F. Fisher, AIA, dated January 31, 1970.
- Drawing sheet A-3, titled *A Facility Study for East Primary School*, by Paul L. Bentley, Architect, AIA, PC, dated February 20, 1998.
- Drawing sheet M3.2, titled *East Primary School*, by MKE Consulting Engineers, dated August 16, 1999.
- Drawing sheets E3.2 through E3.6, and E4.2, without title and by unknown source, with various dates in 1999 and 2000.
- Drawing sheets FP1 and FP2, titled *East Primary School – Sutherlin School District*, by Oregon Automatic Sprinkler Co., dated December 9, 1999, and December 10, 1999, respectively.
- For the Cafeteria Building, *FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards* report card completed in 2006 as part of the Oregon Department of Geology and Mineral Industry (DOGAMI) Statewide Seismic Needs Assessment.

A FEMA 154 report card was not completed as part of the 2006 DOGAMI effort for the campus' Main Building.

Observed or Potential Structural Deficiencies:

No visible signs of structural damage or distress were observed during our field reconnaissance.

A broken gutter above the Lower Level exterior door entry between the north and south classroom wings of the Main Building was observed to result in a cascade of rainwater, ponding atop the adjacent sidewalk and staining to the adjacent CMU wainscot veneer. If left unattended, eventual structural damage to the exterior wood wall framing and/or settlement of the supporting footing could occur. We recommend that the gutter be repaired.

Through the FEMA 154 efforts completed on behalf of DOGAMI in 2006, primary building components of the Cafeteria Building were evaluated and assigned an RVS score. The Cafeteria Building was assigned a score of 2.8, thereby implying that the structure has a 1 in $10^{2.8}$, or 0.2% chance, of collapse during a "maximum considered earthquake" expected to recur every 2,500 years. FEMA recommends buildings with final RVS scores of 2 or less be investigated further using the evaluation procedures of ASCE/SEI 41-13, which can more accurately measure both Life Safety and Collapse Prevention seismic performance objectives. A more thorough evaluation in accordance with ASCE/SEI 41-13 is beyond the scope of this facilities conditions assessment, and to the best of our knowledge has not been completed. Please note that FEMA 154 scoring is by nature cursory and inexact, is prone to error should the evaluator be inexperienced, and can therefore at times lead to incorrect conclusions regarding seismic risk. We believe the East Primary School Cafeteria Building may have a higher risk of potential collapse than what is indicated with its FEMA 154 RVS score.

Some potential seismic-related structural deficiencies of the Cafeteria Building were identified through our field reconnaissance. These include, but are not necessarily limited to, the following:

- The offset between the perimeter canted wood-framed walls and concrete walls below results in a discontinuous in-plane seismic load path.
- Wood roof decking provides very little in-plane shear resistance without supplemental plywood sheathing. Given the assumed vintage of this building, it is unlikely supplemental plywood exists unless it was added as part of a subsequent re-roof project.

For buildings with this type of construction and vintage, the following seismic deficiencies may also be found to exist with a more thorough evaluation:

- Inadequate anchorage of the tops of concrete walls to the Main Level floor to transfer out-of-plane forces.
- Inadequate connection of the roofs and/or floors to the concrete walls to transfer in-plane forces.

- Inadequate concrete reinforcing and/or inadequate lap splices between reinforcing bars.
- Inadequate strength and stiffness of roof and floor diaphragms.
- Diaphragm discontinuities, e.g., steps in roof elevations, reentrant (inside) corners, etc.
- Overstressed wood stud shear walls, e.g. walls that are too short and/or don't have structural sheathing.
- Exterior canopies with no apparent lateral system.

The seismic deficiencies noted above could put portions of the Cafeteria Building at risk of partial collapse during a major seismic event and thereby endanger the safety of the building's occupants. A more comprehensive structural evaluation – like that of an ASCE/SEI 41-13 evaluation – is necessary to fully identify all potential seismic deficiencies, quantify the risks associated with them, and determine what retrofit measures may be employed to mitigate those risks.

Given its date of construction, the Main Building of East Primary School incorporates modern seismic design and detailing practices. Therefore, in accordance with *ASCE/SEI 41-13 Seismic Evaluation and Retrofit of Existing Buildings*, the building is classified as a benchmark building, presumed to provide acceptable life-safety protection to its occupants during a major seismic event. Further seismic evaluation of the Main Building is unwarranted.

West Intermediate School

Building Structure Description:

There are ten primary building structures on the West Intermediate School campus. The school is located at 531 N Comstock Avenue in Sutherlin, Oregon.

The single-story Main Building (designated as Building A on your plans) incorporates a cafetorium on the east end, administrative offices to the south, a library to the west, and a kitchen and boiler room on the far north end. Drawings of the Main Building were unavailable for our review; however, the FEMA 154 report card for this portion of the school indicates the date of construction as 1953. Based upon observations made during our field reconnaissance, construction of the Main Building appears to consist primarily of concrete slab on grade, perimeter and interior wood-framed bearing and shear walls, and a wood-framed roof. The boiler room is constructed of perimeter concrete walls and a roof of structural steel beams supporting a concrete slab. The roof of the cafetorium appears to incorporate cement fiber panels and steel bulb tees between timber roof purlins and primary long-span timber beams. The remaining areas of roof appear to incorporate tongue and groove wood decking. The cafetorium roof is significantly higher than the remaining areas of the building. A breezeway canopy extends from the south and west sides of the Main Building; construction consists of 2x tongue & groove decking spanning to 2x joists and timber beams and posts along the canopy's outboard edge.

The single-story Music Building (designated as Building B on your plans) appears to consist of perimeter wood-framed walls and a mono-sloped wood-framed roof. A wood-framed breezeway canopy of construction matching that of the remainder of the campus connects the southwest corner of the Music Building with the northern-most Classroom Building. Drawings of the Music Building were unavailable for our review, and a FEMA 154 report card was not completed as part of the 2006 DOGAMI effort. The date of construction is unknown.

There are four nearly identical single-story Classroom Buildings (designated as Buildings C through F on your plans). Based upon observations made during our field reconnaissance, construction of the Classroom Buildings appears to consist of perimeter wood-framed walls, tongue & groove wood roof decking, and timber roof beams. There are no solid walls along the north sides of the Classroom Buildings; construction along these sides consists solely of windows between the wood posts atop a partial-height concrete retaining wall. The roofs of the Classroom Buildings are folded to create a vertical step in elevation along the long direction. The roofs extend to the north to form a breezeway canopy of construction matching that of the remainder of the campus. Drawings of the Classroom Buildings were unavailable for our review; however, the FEMA 154 report card for this portion of the school indicates the date of construction as 1953.

There are four small modular buildings (designated as Buildings G through K on your plans) at the far south side of the campus. We believe these single-story structures were built sometime around or after 1998. Construction of these modular buildings consist of shallow reinforced concrete footings, a wood-framed ground floor over a crawl space, perimeter wood-framed walls, and a wood-framed gabled roof.

Other small buildings, portables, sheds or accessory structures on the West Intermediate School campus not specifically mentioned above were not reviewed and are outside the scope of this assessment.

Documentation Review:

We reviewed the following materials documenting the building structure:

- Drawing sheets 1 through 5, titled *28' x 64' Modular Classroom, Sutherlin School*, by Modern Building Systems, Inc., dated May 4, 1998.
- *FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards* report card completed in 2006 as part of the Oregon Department of Geology and Mineral Industry (DOGAMI) Statewide Seismic Needs Assessment.

FEMA 154 report cards were not completed as part of the 2006 DOGAMI effort for the Music Building or any of the four modular buildings mentioned above.

Observed or Potential Structural Deficiencies:

At the cafetorium room within the Main Building, we observed a single purlin-to-beam saddle connection that has been reinforced with a bolted steel angle bracket. We have no reason to believe that this reinforced connection isn't sufficient to rectify whatever structural issue required its installation. There was no associated documentation available. We also saw no

evidence to suggest that the remainder of the original purlin-to-saddle connections are a structural concern.

We observed dry rot at various areas of wood siding at the Main Building and at the Classroom Buildings. Dry rot within building finishes doesn't necessarily indicate that damage to the underlying wood-framed wall exists.

Spalling of the sidewalk concrete was observed at the anchored base of a breezeway post near the southwest corner of Classroom Building E. It appears that a concrete patch was attempted at some point. We recommend that a horizontal hooked reinforcing dowel be epoxied into place to positively engage the post base rod, and that the corner of concrete paving slab then be re-patched.

Through the FEMA 154 efforts completed on behalf of DOGAMI in 2006, primary building components were evaluated and assigned RVS scores. The results are as follows:

Building	RVS Score	Collapse Probability
Main Building	1.3	5.0%
Music Building	n/a	Unknown
Classroom Buildings (C – F)	3.8	< 0.1%

The collapse probabilities presented above represent the chance of structural collapse during a "maximum considered earthquake" expected to recur every 2,500 years. FEMA recommends buildings with final RVS scores of 2 or less be investigated further using the evaluation procedures of ASCE/SEI 41-13, which can more accurately measure both Life Safety and Collapse Prevention seismic performance objectives. A more thorough evaluation in accordance with ASCE/SEI 41-13 is beyond the scope of this facilities conditions assessment, and to the best of our knowledge has not been completed. Please note that FEMA 154 scoring is by nature cursory and inexact, is prone to error should the evaluator be inexperienced, and can therefore at times lead to incorrect conclusions regarding seismic risk. In the case of West Intermediate School, we believe the Classroom Buildings (Buildings C through F) may have a higher risk of potential collapse than what is indicated with their FEMA 154 RVS score.

Some potential seismic-related structural deficiencies were identified through our cursory review of the original drawings and our field reconnaissance. These include, but are not necessarily limited to, the following:

- At the Main Building, the west exterior wall of the cafetorium lands atop partial-height transverse walls, thereby creating a discontinuity in load path. This may compromise the ability of in-plane seismic loads to effectively transfer to the building foundation.
- The prevalent use of open-front construction with windows along the north sides of the Classroom Buildings may result in inadequate seismic resistance in the long direction of these buildings.

- Wood roof decking provides very little in-plane shear resistance without supplemental plywood sheathing. Given the assumed vintage of these buildings, it is unlikely supplemental plywood exists unless it was added as part of a subsequent re-roof project.
- Cement fiber panels, if indeed used at the roof of the cafetorium within the Main Building, provide only limited (and perhaps insufficient) in-plane shear resistance.
- The high length-to-width aspect ratio of the breezeway roofs connecting the various buildings on campus may result insufficient diaphragm shear capacity when resisting seismic forces in their transverse direction.

For buildings with this type of construction and vintage, the following seismic deficiencies may also be found to exist with a more thorough evaluation:

- A lateral system that does not continue all the way from the roof to the foundation (discontinuous load path).
- Inadequate anchorage of the tops of concrete walls to wood framing above to transfer out-of-plane forces.
- Inadequate connection of wood-framed walls to concrete walls below to transfer in-plane forces.
- Inadequate concrete reinforcing and/or inadequate lap splices between reinforcing bars.
- Inadequate strength and stiffness of roof and floor diaphragms.
- Diaphragm discontinuities, e.g., steps in roof elevations, reentrant (inside) corners, etc.
- Overstressed wood stud shear walls, e.g. walls that are too short and/or don't have structural sheathing.
- Exterior canopies and/or breezeways with no apparent lateral system.

The seismic deficiencies noted above could put portions of the buildings at risk of partial collapse during a major seismic event and thereby endanger the safety of the buildings' occupants. A more comprehensive structural evaluation – like that of an ASCE/SEI 41-13 evaluation – is necessary to fully identify all potential seismic deficiencies, quantify the risks associated with them, and determine what retrofit measures may be employed to mitigate those risks.

Given their date of construction, the four modular buildings on the south end of campus incorporate modern seismic design and detailing practices. Therefore, in accordance with *ASCE/SEI 41-13 Seismic Evaluation and Retrofit of Existing Buildings*, these buildings are classified as benchmark buildings, presumed to provide acceptable life-safety protection to its occupants during a major seismic event. Further seismic evaluation of these modular buildings is unwarranted.

The opinions and recommendations presented in this assessment report were developed with the care commonly used as the state of practice of the profession within the scope limitations mentioned above. No other warranties are included, either expressed or implied, as to the professional advice included in this report. This report has been prepared for Soderstrom Architects and its assigns to be used solely in the evaluation of the buildings addressed herein.

If the District is interested in a more comprehensive structural evaluation and/or retrofit of their schools, we are happy to present a proposal for that scope of work. Feel free to contact us if you have any questions.

Sincerely,

catena consulting engineers

Jason Thompson, P.E., S.E.
Principal