Oregon Schools Seismic Feedback Form

General information:

1. Date of submittal
September 26, 2012
2. County
Benton
3. School district or special education district
Benton County (Philomath) School District 17J
4. Name and title of person submitting report
Kelly Howard Business Manager 541-929-3169
5. Year for reporting – Please submit separate forms for each year of reporting
2012

Specific information:

6. Did the district replace any school structures with new buildings during the reporting year?

Yes ☒

No ○

a. If No please go to question #7

b. If Yes please fill out the following information FOR EACH STRUCTURE that was replaced

i. Name and address of the school where structure was replaced

Philomath High School
2054 Applegate St.
Philomath, OR 97370

ii. Exact structure or structures that were replaced (for example, gymnasium, main building, etc.)

2 story Classroom wing, Administrative offices, Kitchen, gymnasium complex, locker rooms, activity rooms

iii. Type of replacement building (for example, tilt-up, masonry, wood frame, etc.)

Tilt up concrete, steel studs, steel roof structure

iv. Maximum occupancy of new structure

1407

v. Date the new structure became occupied

9/10/2012

i. Name and address of the school where structure was replaced
N/A
ii. Exact structure or structures that were replaced (for example, gymnasium, main building, etc.)
iii. Type of replacement building (for example, tilt-up, masonry, wood frame, etc.)
iv. Maximum occupancy of new structure
v. Date the new structure became occupied

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7. Did the district modify an existing school building in a manner that may affect the seismic risk category of a school?
Yes ⊗ No ○
a. If No you are finished – Please go to the end of the form for submittal instructions b. If Yes please fill out the following information FOR EACH STRUCTURE that was modified
i. Name and address of the school where structure was modified
Philomath Middle School 2021 Chapel Drive Philomath, OR 97370
ii. Exact structure or structures that were modified (for example, gymnasium, main building, etc.)
Roof structure + supports for main building, including gymnasium.
iii. Type of modification to the building (for example, awnings anchored, structural reinforcement, etc.)
Seismic upgrades to roof structure including roof diaphram & also shear wall upgrades, anchor bolts
iv. Date the structure was re-occupied after modification
9/10/2012
c. Optional – submit a copy of the seismic rehabilitation or structural engineering report
Please attach to email when you submit this form. See attached report by Lewis + VanVleet
d. Optional – cost and method of seismic rehabilitation funding (grant through Seismic Rehabilitation Grant Program, local school bond, etc.)
SRGP $284,920 + Local School Bond Funds

i. Name and address of the school where structure was modified
Philomath High School 2054 Applegate St. Philomath, OR 97370
ii. Exact structure or structures that were modified (for example, gymnasium, main building, etc.)
Gymnasium modified into student commons & auditorium, existing South classroom wing renovated, Pool & Applied Tech areas.
iii. Type of modification to the building (for example, awnings anchored, structural reinforcement, etc.)
In old gym, new shear walls & roof diaphram, South classroom wing, pool & Applied Tech have shearwall upgrades.
iv. Date the structure was re-occupied after modification
Classroom wing renovation 9/4/2011 Auditorium, Pool & Applied Technology 9/10/2012
c. Optional - submit a copy of the seismic rehabilitation or structural engineering report
Please attach to email when you submit this form.
d. Optional - cost and method of seismic rehabilitation funding (grant through Seismic Rehabilitation Grant Program, local school bond, etc.)
Local School Bond funds

i. Name and address of the school where structure was modified
Philomath Elementary School 239 South 16th Street Philomath, OR 97370
ii. Exact structure or structures that were modified (for example, gymnasium, main building, etc.)
Renovation of old west classroom wing -
iii. Type of modification to the building (for example, awnings anchored, structural reinforcement, etc.)
Plywood roof diaphram & plywood shear walls. Shear walls in classrooms. Seismic anchors between wall & roof.
iv. Date the structure was re-occupied after modification
9/4/2011
c. Optional - submit a copy of the seismic rehabilitation or structural engineering report
Please attach to email when you submit this form.
d. Optional - cost and method of seismic rehabilitation funding (grant through Seismic Rehabilitation Grant Program, local school bond, etc.)
Local School Bonds

i. Name and address of the school where structure was modified
ii. Exact structure or structures that were modified (for example, gymnasium, main building, etc.)
iii. Type of modification to the building (for example, awnings anchored, structural reinforcement, etc.)
iv. Date the structure was re-occupied after modification
c. Optional – submit a copy of the seismic rehabilitation or structural engineering report
Please attach to email when you submit this form.
d. Optional – cost and method of seismic rehabilitation funding (grant through Seismic Rehabilitation Grant Program, local school bond, etc.)
Please submit your completed report to: **seismic.feedback@dogami.state.or.us** **Thank you for your cooperation.**

LEWIS &
VAN VLEET
incorporated

principals
chris c. van vleet, p.e.
gary j. lewis, p.e.

October 13, 2010

Arbuckle Costic Architects
Attn: Clayton Vorse
363 State Street
Salem, OR. 97301

RE: Philomath Middle School Seismic Evaluation

Dear Mr. Vorse:

Our firm was retained to perform a seismic evaluation of the Philomath Middle School Building in Philomath, Oregon. We understand that the purpose of this evaluation is twofold. Currently the school district is planning to replace the existing roof of the building and would like to perform any seismic upgrades to the roof diaphragm that would require the removal of the roofing. Additionally, the report is to help the school district plan future seismic upgrade projects and obtain funding for seismic upgrade projects. After performing our evaluation, it is our opinion that the building should perform relatively well in its present condition under minor to moderate earthquake forces, but will likely sustain heavy damage in the event of a full code design earthquake.

Accompanying this report is a floor plan which indicates which walls are existing shear walls and which walls are existing masonry walls. This plan also indicates which walls we would recommend be upgraded in the future to be plywood sheathed shear walls.

REPORT METHODOLOGY

We were provided with a set of original architectural and structural drawings for the existing building in order to assist with the preparation of this report. These drawings are legible and of decent quality with some of the building's structural conditions clearly detailed. However, not all of the relevant structural as-built conditions were detailed. Our evaluation is based on the assumption that the information shown in the drawings is reliable.

Our evaluation compared the capacity of the building's lateral force resisting elements to the seismic loads prescribed in the current 2010 Oregon Specialty Structural Code (OSSC). This code is based on the 2009 International Building Code (IBC). It is the intent of this code that facilities such as schools perform during earthquakes at a higher level than typical buildings. There are several descriptive phrases that describe a buildings performance in an earthquake. At an "immediate occupancy" performance, a building should survive an earthquake with minimal damage, and that damage

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should not seriously impair the building's functions. This performance level is what the code requires for buildings necessary for responding to a disaster such as fire stations or hospitals. Typical buildings are only required to perform to a "life safety" level. At this level the building's occupants should survive without serious injury. However, the building can sustain considerable damage, and may not necessarily remain functional or be salvageable afterwards. Buildings such as schools have design intent that is something of an elevated life-safety standard which is sometimes referred to as "damage control". It is the opinion of the code writers that the minimum standards for schools should be somewhat elevated to provide an extra measure of safety compared to typical buildings. Buildings that are designed to an elevated life safety standard are designed for 125% of the seismic load of buildings designed to a typical life safety level.

When comparisons are made between element capacities and code loads in this report, those comparisons are to the elevated life safety level loads. Therefore, if the report states that an element has approximately 80% of the required strength, it would be very close to having adequate strength at a typical life safety level. If the report states that an element has either more or less than 80% of the required strength, it would either have or not have the required strength at a life safety level.

Our evaluation focused solely on the structural elements in this building. Evaluating non-structural elements including items such as ceilings, mechanical equipment, veneer, and furniture is beyond the scope of this report.

EXISTING BUILDING SUMMARY

Philomath Middle School is primarily a single story wood framed structure. It was designed in 1972 presumably to the then current Uniform Building Code Seismic Zone 2 and for a lateral wind load of 15 psf. The design seismic load in the 1970 UBC seismic zone 2 load is approximately 50% of the current OSSC seismic load for this type of building in located in Philomath Oregon. In 1999 there was a 3600 square foot addition constructed on the north side of the main building. This addition is an open wood framed canopy with steel columns and concrete masonry unit (CMU) walls.

The main building is approximately 63,500 square feet in area. Most of that building is a one story structure with a low slope roof framed with open web roof joists and plywood roof sheathing. The roof height varies but is approximately 16' above finish floor. The roof joists are supported by bearing walls, wood beams, wood posts and steel columns. There are areas of non-structural brick veneer on the buildings exterior, primarily on the south, east, and west sides. The building is braced by wood framed shear walls sheathed with ½" plywood. The drawings indicate that the plywood sheathing on the shear walls were nailed with 8d nails at 6" O.C. at all panel edges and at 12" O.C. in the field. The foundation details call for ¾" diameter sill plate anchor bolts at 48" O.C. at the exterior walls and ½" diameter anchor bolts at 48" O.C. at the interior walls. The ¾" diameter anchor bolts have a higher allowable capacity than the shear wall sheathing; however the ½" diameter anchor bolts have only 91% of the shear wall sheathing capacity. The drawings do not indicate that any holdowns at the ends of shear walls were used to resist overturning forces on those walls. The building has a concrete slab on grade floor throughout, and the foundation is conventional concrete spread and continuous footings.

There are some areas on the north side of the main building that were built differently than the majority of the structure. The gymnasium and multipurpose rooms have an approximately 25' high wood roof. The roof is framed with 4" nominal wood decking spanning between large gluelam beams. The gluelam beams are supported by tube steel columns inside the walls. In some framing details, ½" plywood sheathing is called for over the 4" decking, however, this is not noted at all conditions.

There are two areas where masonry walls were built, at the interior walls of the boiler room in the northwest corner of the building, and dividing the boys' and girls' locker rooms in the northeast corner of the building. The masonry details for the building include a detail showing masonry walls being reinforced with (1) #5 vertical at 24" O.C. and no horizontal reinforcement save two continuous #5 bars in a bond beam at the top of the wall, however this detail is only flagged at the boiler room east and north wall. This detail did not appear to be flagged at any other masonry wall, so it is not clear that those other walls were reinforced. The boiler room masonry walls were built up to the roof sheathing or framing level. At the locker room walls, it appears that they stopped the top of the walls below the roof framing elevation with wood kicker braces to the roof joists.

In the center of the building, the main building roof is popped up and there is a wood framed mechanical mezzanine.

The canopy addition on the north side of the building with wood I joists spanning between gluelam beams. The canopy is seismically separated from the main building. It is braced by ordinary steel concentric braced frames on three sides and CMU walls on the south side.

SEISMIC EVALUATION

There are several areas where the existing structure does not meet current building codes for seismic resistance. This should to be expected, given the age of the building. Some aspects of the following comments apply to the building generally, some apply to certain elements in the building specifically. The following items are listed in order of what we consider to be most important to least important.

1. The drawings indicate that the original building designers did not provide adequate connections between the shear walls and the roof diaphragm or clearly detailed load paths between the roof and the walls. There are no dedicated collector elements to tie the buildings roof to the shear walls. In an earthquake, the seismic load will be spread out evenly across the roof. A collector element (also sometimes referred to as a drag strut) would be an element like a beam line or wall plate line that would extend across the building that would "collect" the dispersed load and provide a path for the load to reach a shear wall. At exterior shear walls, the shear wall sheathing typically runs continuously up to the bottom of exterior soffits and canopies rather than running continuously up to the roof. Instead, the sheathing bumps out to the edge of the soffit making for a convoluted load path that is not detailed in the drawings. See the marks on a typical exterior detail accompanying this report as an example.

2. The connection between the masonry walls and the roof are not adequate to resist the code-required out of plane anchorage forces. The adequacy of the connection and the implications of a connection failure vary depending on whether it is the masonry walls at the boiler room or the masonry walls at the locker rooms. At the locker rooms, the kicker braces as detailed will have very little if any capacity to brace the wall. Should these walls fail, the collapsing masonry will cause a life-safety hazard to any individual in the area of the walls, but should not cause much damage to other structural elements. At the boiler rooms the out of plane connection consists of a 2x wood sill plate bolted to the top of the wall with ½" diameter anchor bolts at 48" O.C. At locations where the roof joists run perpendicular to the wall, the joist top chord sits on top of that wall providing bracing. At locations where the joists run parallel to the wall, the drawings indicate that the wall was built up to the underside of the roof sheathing, allowing for nailing of the sheathing to the wood plate for out of plane bracing. The wood plate anchor bolts do not

have the code required capacity. It is not clear how the roof sheathing may have been nailed to the wood plate, but it is probable that it was not nailed adequately. Even though the boiler room walls do not have an adequate connection to meet code required capacities, there should be a positive connection that will provide some anchorage of the walls, unlike at the locker room walls. However, because the boiler room walls also support roof joists, the failure of the connection/wall could lead to a partial collapse of the roof, unlike at the locker rooms where the roof is largely isolated from the walls. This analysis assumes that all of the masonry walls were reinforced. As was noted earlier, it is unclear if all of the masonry walls were reinforced.

3. In the event of a code level earthquake, most of the wood shear walls in the building would receive more load than their allowable capacities. The shear wall lines at grids B, F, 1, 3 and 4 have adequate shear capacity to meet the code required loads, but the other wall lines do not. The overstressed walls typically have between 60% and 80% of the code required shear capacity. The drawings did not indicate that holdowns were used at any of the shear walls in this building. Many shear walls, particularly walls running in the east-west direction require light to medium capacity holdowns with up to a 6250 lbs uplift capacity. At the walls with higher uplift loads, it is possible that the foundations do not have an adequate capacity for a code level earthquake, but we can not accurately evaluate the foundations without knowing the allowable soil bearing pressure for the soil. This would require an evaluation and report from a geotechnical engineer. For the purpose of our analysis, it was assumed that a shear wall line exists at grid 3.9. Without a shear wall line at either grid 3.9 and/or 4, the shear walls at grids C and E would be greatly overstressed. As it is, there are extensive gypsum sheathed bearing walls at grids 3.9 and 4 that will provide a significant amount of shear resistance, though not enough to meet current code loads.

The covered roof addition was not analyzed as part of this report. Considering the age and nature of the addition, it should perform well in an earthquake. This addition meets the American Society of Civil Engineers Standard 31 (seismic evaluation of existing buildings) "benchmark building" definition and in our opinion does not require further evaluation.

SEISMIC HAZARD MITIGATION DURING THE ROOF MEMEBRANE REPLACEMENT

In this section, we will cover possible methods for reducing some of the seismic hazards noted above during the planned removal and replacement of the existing roof membrane. The drawings typically call for the placement of rigid insulation on top of the roof sheathing. In order to make any structural upgrades, some removal and replacement of the existing insulation will be required. In most perimeter wall conditions and at steps in the roof height, framed crickets were constructed. In order to make some of the recommended upgrades, the removal and replacement of those crickets will be required.

The first priority should be to improve the connections between the roof diaphragm and the shear walls. The various steps in the roof will preclude being able to install new collector elements to all of the shear walls without significant work inside the building, but improvements can be made. New continuous light gauge coil straps can be installed, tying beams to walls or across the building and nailing into each joist that the strap will cross. Joists in the east-west direction often vary in spacing, making direct joist to joist strapping impossible. Custom steel connections can be fabricated that would tie offset joists together. These custom steel connections would be buried in the rigid roof insulation. In areas where a dedicated collector element cannot be installed, we would recommend that additional nailing of roof sheathing be made such that the connection between roof sheathing and the shear wall is enough to transfer the required load to the wall, even though there may not be a specifically designed element to bring the load to the wall.

At the boiler room masonry walls, we would recommend that new anchor bolts be installed to connect the wood top plate to the masonry below. The bolt head for those anchors would be countersunk in the roof sheathing. At that time, the nailing of the roof sheathing to the wall plate can be determined and increased as required.

FUTURE COMPREHENSIVE SEISMIC HAZARD MITIGATION

It is our understanding that at this time more comprehensive seismic upgrades to the building are at a very preliminary planning stage. In this section we will discuss some of the potential future seismic upgrades that we would recommend be considered.

A. There are several upgrades that should be made to the existing wood sheathed shear walls (item #3 previously noted). At locations where the existing walls are overstressed, either the nailing of existing wall sheathing will need to be increased or new shear wall sheathing added on the other side of the wall. Additional wall sill plate anchor bolts will be needed and new holdowns will need to be installed. New posts will need to be installed inside the walls at holdown locations and new studs will need to be installed at shear walls that require heavy nailing. This can be problematic at locations with existing electrical conduit, plumbing or other similar things inside the wall. Extensive removal and replacement of wall finishes on one side of shear walls will be required. As was noted previously, the existing bearing walls at either grid 3.9 or 4 will need to be upgraded with new wood sheathing and holdowns.

B. At the existing perimeter shear walls with offset parapets and soffits, as was noted in item 1, the load path from the roof to the shear wall below is convoluted. We recommend that new shear wall sheathing be installed from where the shear wall sheathing stops below, to the wall top plate. See the accompanying marks noted on an existing wall detail for more information.

C. At locations where the roof elevation steps, new vertical members or kicker braces may need to be installed to tie the lower roof to the higher roof or shear wall.

D. At the locker room masonry walls, a new kicker brace system will need to be installed. These kicker braces would run up to the roof /joist top chord level rather than stopping at the joist bottom chords as detailed. From there new blocking and strapping can be added as required to transfer the anchorage load into the roof diaphragm. It may be possible to incorporate that new blocking and strapping into the current reroofing plans.

CONCLUSION

In order to design a comprehensive seismic upgrade, it would be appropriate to perform a more comprehensive investigation of the as-built condition. A materials testing agency should be retained to determine whether or not the existing masonry reinforcement appears to comply with the drawings. If possible, the existing ceilings and other finishes should be removed in places to allow for observation of the as built construction. Additionally, a geotechnical engineer should be retained to perform a site specific soils analysis.

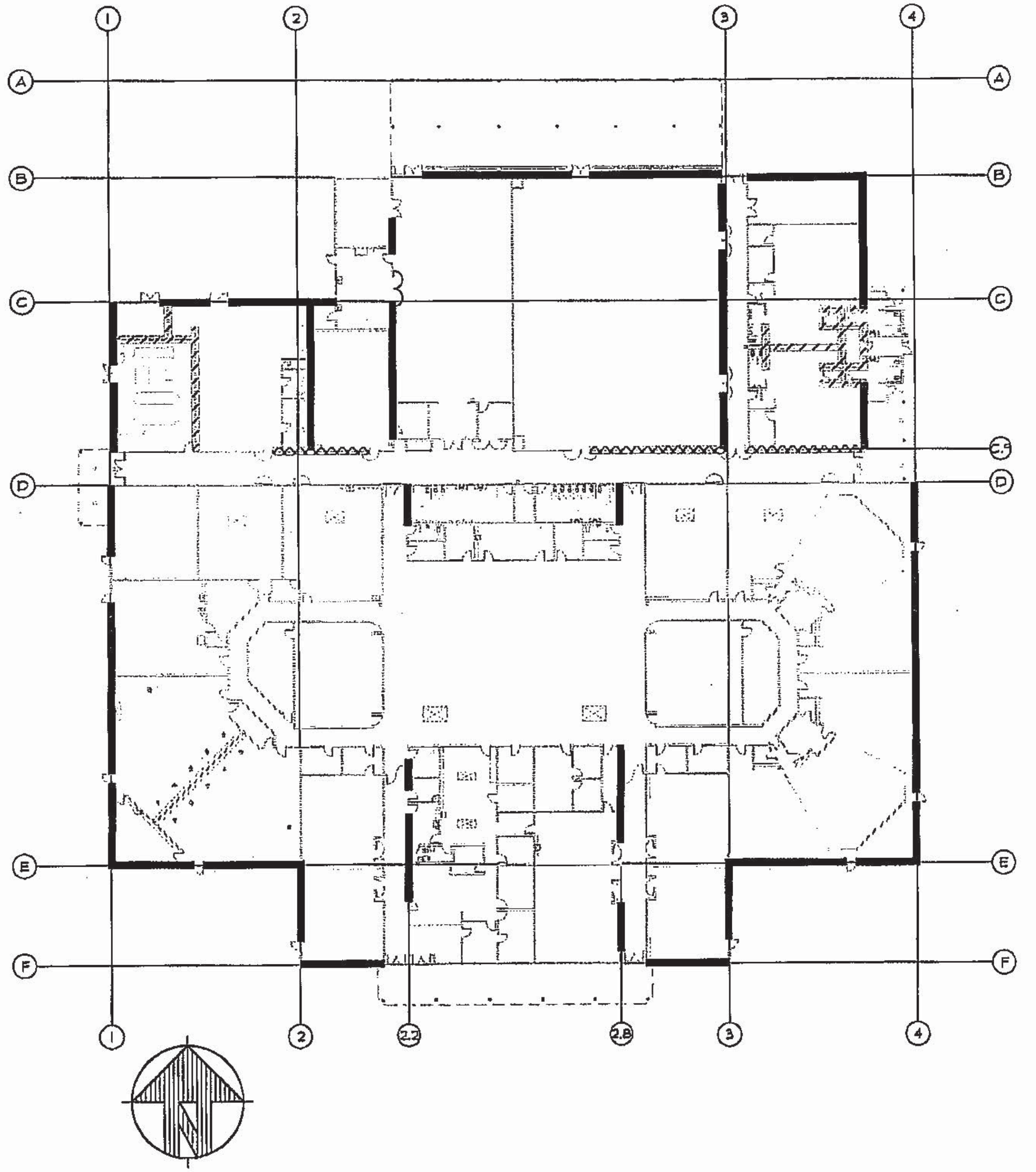
This report documents a number of areas where the current building does not have an adequate capacity to meet code seismic forces. However, one story wood framed structures that are anchored to the foundations, that are located on a level lot, that do not have a basement or crawl space, and were not built over liquefiable soil commonly do not incur catastrophic damage in earthquakes. There are several reasons for this, relating to the simplifications and assumptions engineers must make in analyzing a wood framed structure. For example, buildings such as this school have gypsum sheathed bearing walls and non-bearing partitions that provide additional shear resistance not considered in a typical analysis of the building. Also, the building code does not allow for the use of wood sheathing to act as a tension tie or collector element. However, the plywood sheathing has some capacity to act in that fashion. For reasons such as those, we feel that the overall building structure will perform better in an earthquake than would be expected based on a analysis of individual parts of the building. However, we cannot say with that the overall performance of the building will be satisfactory to ensure the life safety of its occupants in the event of a substantial earthquake and that the performance of the masonry wall connections, particularly those in the locker room, will perform well in the event of even a moderate sized earthquake.

We hope this report will assist you with your planning. Please feel free to call if you have any questions.

Lance Cerny P.E.

STRUCTURAL
REGISTERED PROFESSIONAL
ENGINEER
OREGON
JULY 26, 1989
CHRIS C. VAN VLEET
EXPIRES: 6-30-

EXISTING SHEAR WALLS
EXISTING MASONRY WALLS
PROPOSED NEW SHEAR WALLS



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PHILOMATH MIDDLE SCHOOL
2021 CHAPEL DRIVE
PHILOMATH, OREGON 97370

EXISTING WALL TYPES

10/14/2010
DATE

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PROJ NO

A
SHEET NO

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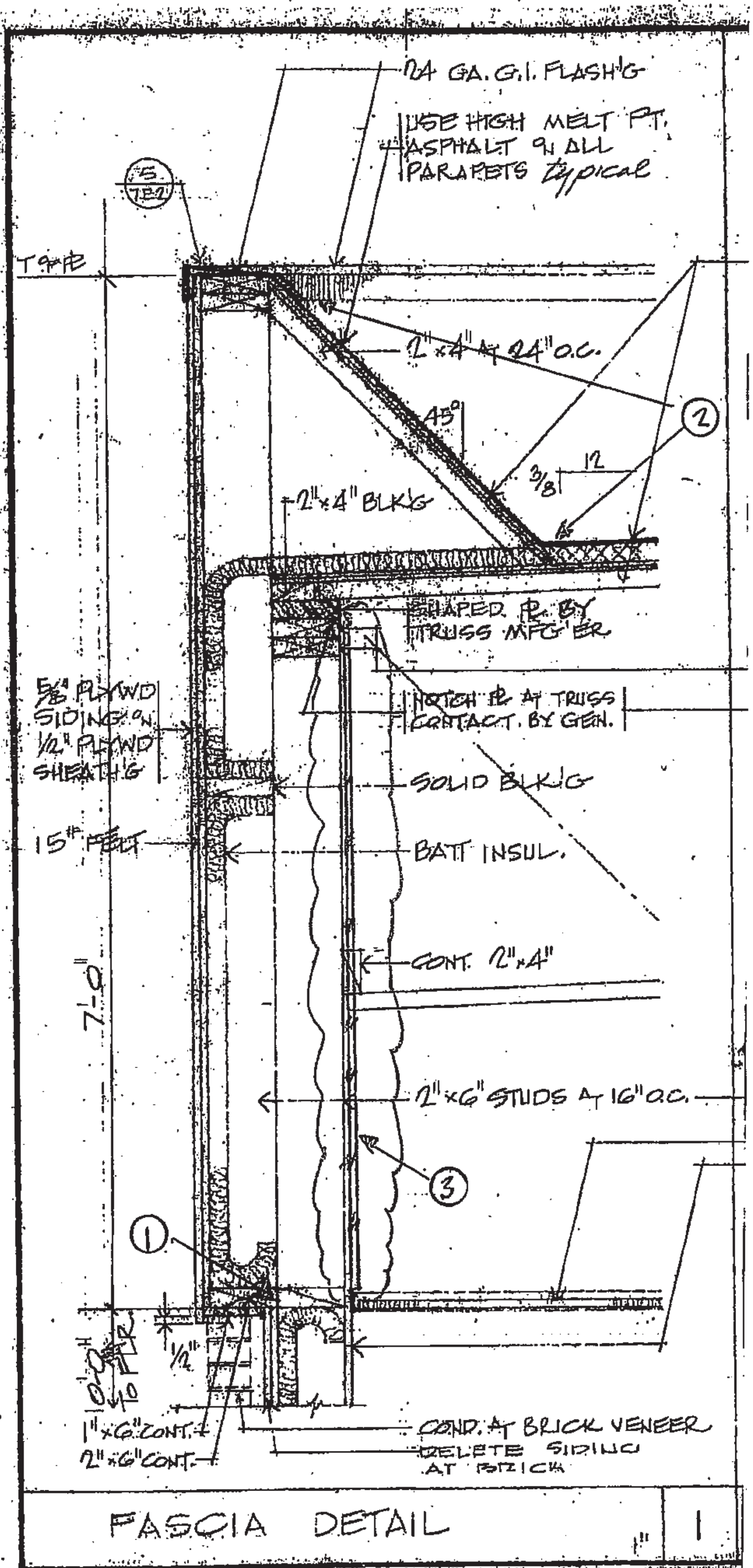

TYPICAL EXTERIOR DETAIL

KEYNOTES

1. THE EXISTING SHEAR WALL SHEATHING STOPS AT THE BASE OF THE SOFFIT, THE CONNECTION BETWEEN THE BLOCK AT THE BASE OF THE FASCIA AND THE SHEATHING IS NOT CLEAR.

2. THE LOAD PATH FROM THE ROOF TO THE SHEAR WALL SHEATHING IS
   - FROM THE ROOF SHEATHING TO THE CRICKET SHEATHING
   - FROM THE CRICKET SHEATHING TO THE FASCIA TOP PL
   - FROM THE FASCIA TOP PL TO THE FASCIA SHEATHING
   - FROM THE FASCIA SHEATHING TO THE FASCIA BOTTOM PL.
   - FROM THE FASCIA BOTTOM PL TO THE SHEAR WALL SHEATHI

3. AS PART OF A FUTURE SEISMIC UPGRADE WE WOULD RECOMEND THE INSTALATION OF NEW SHEAR WALL SHEATHING TO THE WALL TOP PL.

B