May 8, 2015

Carol Gibson
Director of Real Estate
Port of Moses Lake
7810 Andrews Street N.E., Suite 200
Moses Lake, WA 98837

Re: Structural Safety Assessment of Building 408, Port of Moses Lake
C No. 150341

Dear Carol,

We have now completed our investigation and analysis of the current structural condition of Building 408. Our work included a visit to the site on April 8, 2015, for the purpose of inspecting the current structural condition of the building. We also review the following documents forwarded to us by you:

1. Complaint for Declaratory Judgment, Port of Moses Lake v Sonico
2. Addendum to Lease Agreement between the Port of Moses Lake and Sonico
3. Letter dated 12/17/1998 from Kyle Rumble, P.E., to Dave Schott, Architect
4. Building Structural Assessment for The DOH Associates by Pacific Engineering & Design, PLLC, dated 05/13/1998
5. Letter dated 11/10/2011 from Berger ABAM to Mr. Patrick Jones, Port of Moses Lake
6. Preliminary Condition Assessment & Structural Evaluation of Building 408 Primary Roof Structure by Jacobs Engineering Group, Inc., dated 06/15/2012
7. Letter dated 08/22/2012 from The DOH Associates, PS, to Port of Moses Lake
8. Letter dated 01/03/2013 from Western Wood Structures, Inc., to Port of Moses Lake
9. Letter dated 01/14/2013 from Western Wood Structures, Inc., to Port of Moses Lake
10. Truss Inspection and Analysis Port of Moses Lake – Hangar Buildings 401 and 408 Moses Lake, Washington, Dated 03/12/2012 [sic] (correct date – 03/12/2013)
11. Structural Safety Inspection Report Letter from Pacific Engineering to Mr. W.B. Perdue, Sonico, Inc., dated 01/21/2015
12. Structural Safety Inspection Report Letter from Pacific Engineering to Mr. W.B. Perdue, Sonico, Inc., dated 01/21/2015 (revised 02/09/2015)

You have requested that we answer the following two questions:

**Question #1:** Is Building 408 safe for the lessee (Sonico, Inc.) to continue operations in?

**Question #2:** Does the January 21, 2015 Structural Safety Inspection Report completed by Pacific Engineering contain a clear conclusion on whether or not it is safe for the Lessee (Sonico, Inc.) to continue operations in Building 408?

**Summary:**

Question #1: It is our opinion that Building 408 is currently in a potentially very dangerous condition and should not continued to be occupied unless structural repairs and modifications are made. Our site visit observations confirmed that the primary structural framing elements of the roof are continuing to degrade. The repairs initially recommended 17 years ago by Pacific Engineering and each of the subsequent reports by BergerABAM in 2011, Jacobs Engineering Group in 2012, and Western Wood Structures in 2013, have not been installed at this time.

Question #2: We believe that Pacific Engineering's report does contain a clear conclusion – that it is not safe to continue occupying this building. In the Summary and Limitations section of this report, it is stated *"the precise load capacity of the building in its current condition is unknown, and cannot be mathematically determined with any degree of certainty"*. Also in this section of the report, it is noted that even if the building is evacuated every time wind speeds reach 30 mph *"these added safety precautions do not eliminate all risk"*. We understand that risk is associated with almost everything people do. However the level of risk connected with occupying Building 408 exceeds these normal standards by a very large margin.

**Discussion:**

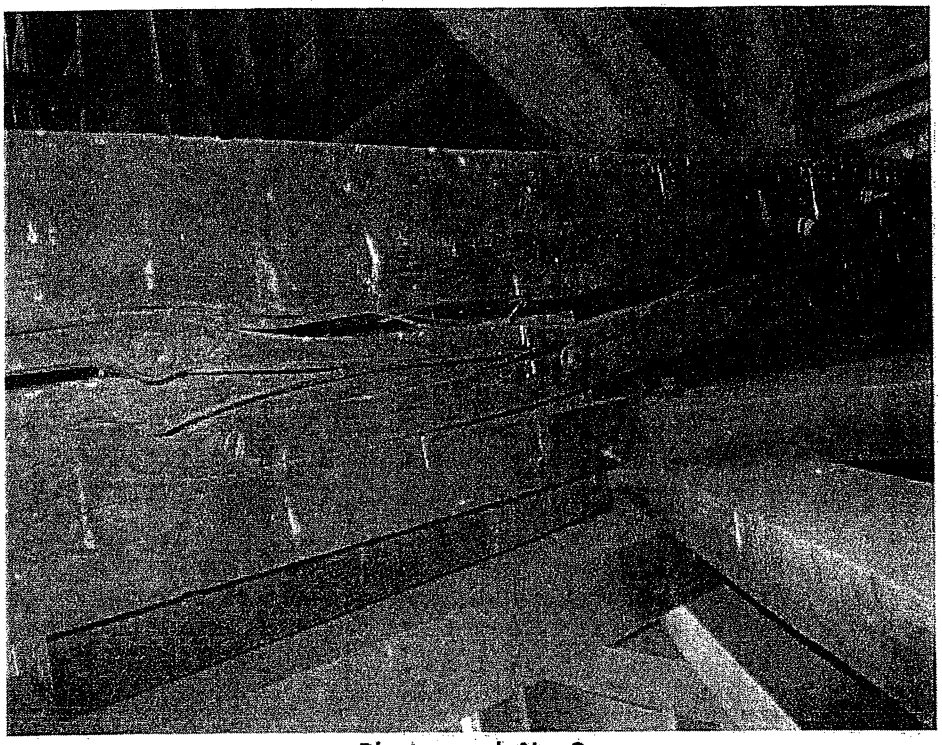
The deteriorated condition of the wood bowstring trusses that comprise the roof structure of Building 408 is well documented by the reports noted at the beginning of this report. In addition, numerous sophisticated computer structural analyses have been performed showing critical elements of the trusses to be stressed to nearly 2 times current allowable levels for wood in good condition when exposed to code roof loadings. We have investigated several bowstring wood truss failures that occurred with no snow load and no wind load on warm summer days. We believe an additional loading that is normally not analyzed helped to trigger these collapses – that loading is thermal. The top chords of bowstring trusses are exposed to higher temperatures on hot sunny days than the bottom chords. This condition results in the top chords trying to increase

in length which is resisted by the increase in tensile force in the bottom chords. We have calculated that the bottom chord tensile forces can increase by at least 5 percent with a 30 degree differential temperature between the top and bottom chords. If a condition exists where a truss is barely able to carry its own weight, this thermal induced increase in loading can result in failure. This thermal loading effect has not been mentioned in any of the previous reports but we think it should be considered when deciding about the continued occupancy of Building 408.

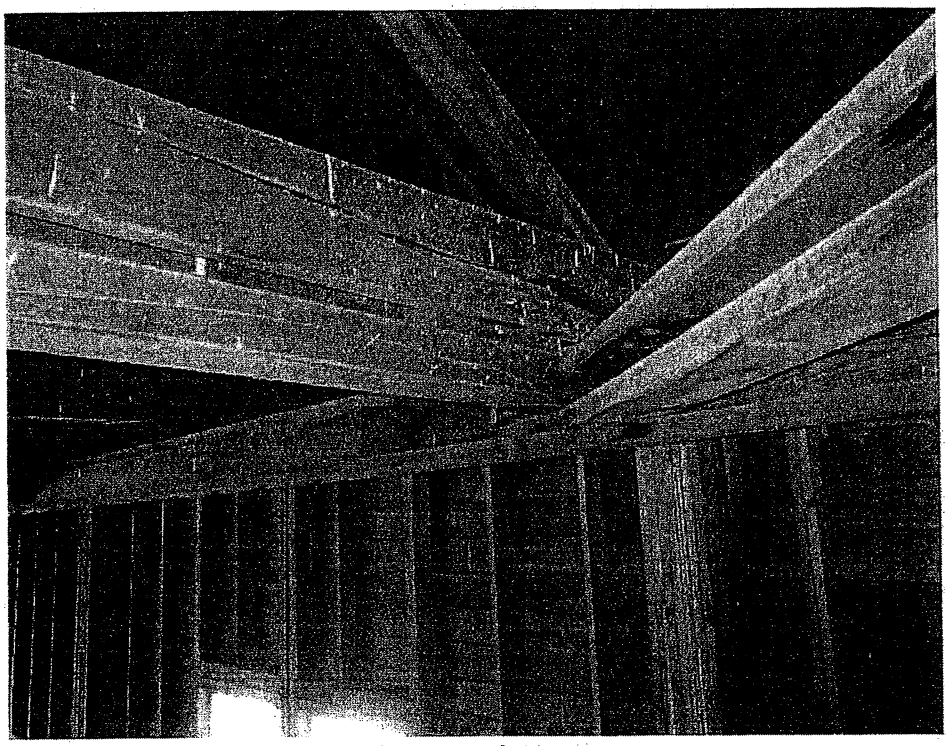
Our observations of the existing conditions found the damage of the structure to be continuing to increase. One example of this is the cross-bracing between the south wall and the first interior truss. The following photographs show how large splits in the horizontal struts at the bottom chord level appear to be relatively recent by the fresh color of the wood in the split zones.

**Photograph No. 1**

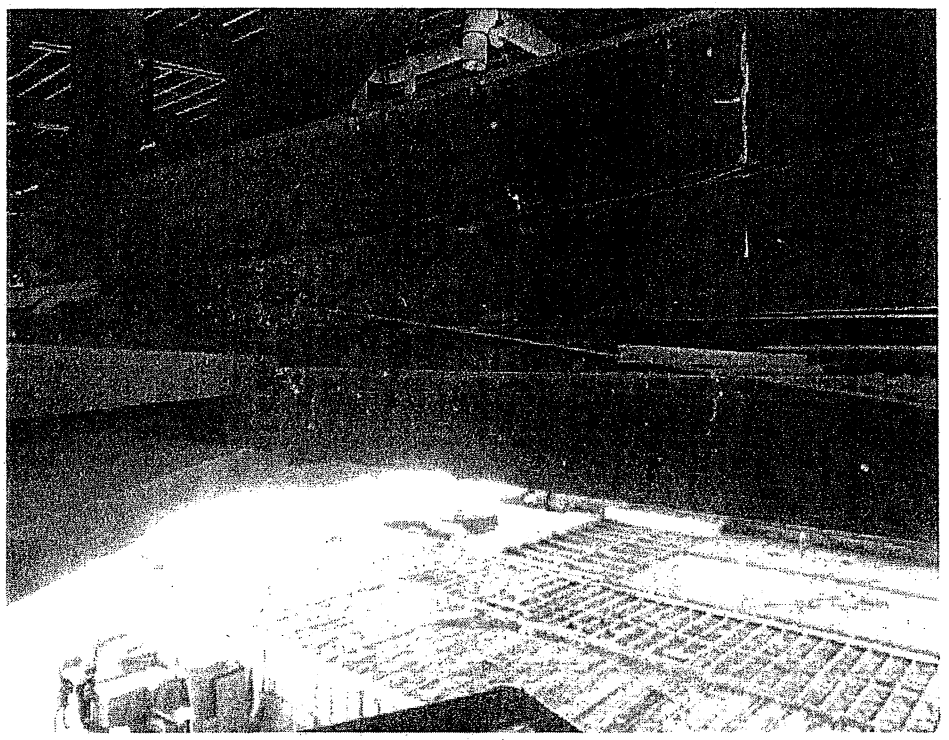
This view is looking south in the southeast portion of the building. This split member is the bottom strut associated with the vertical cross-bracing that transfers wind forces into a horizontal truss that spans across the east-west width of the building.



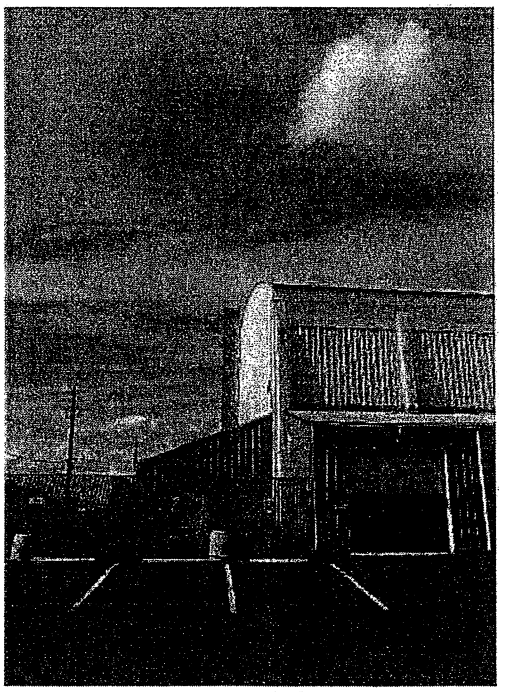
**Photograph No. 2**
This view shows the opposite side of the member in Photograph No. 1.



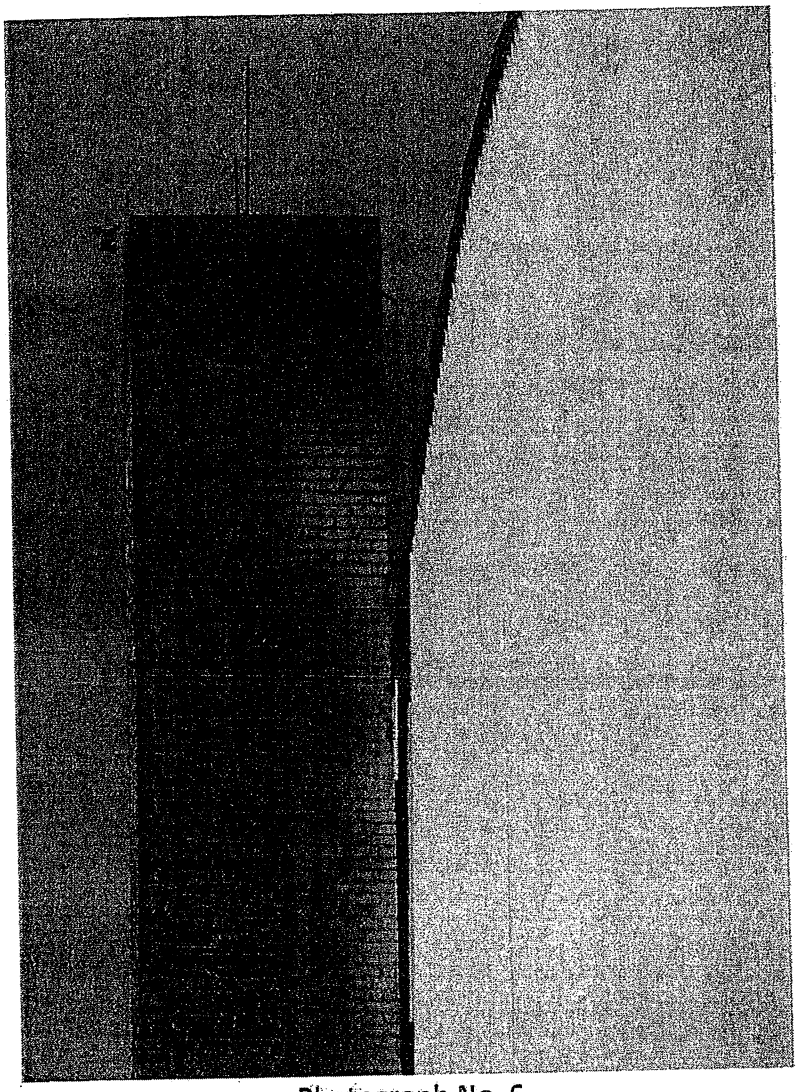
**Photograph No. 3**
This split member wind brace strut is located adjacent to the failed brace shown in Photograph No. 1. The color of the wood in this split looked like the split was recent.



**Photograph No. 4**
This view is looking north and shows the wind struts have splits on both ends.



**Photograph No. 5**
This view is looking west along the south end of Building 408. The failed wind bracing shown by the previous photographs braces the top of this south exterior wall.



**Photograph No. 6**

This view shows how the top of the south wall has moved several inches towards the north resulting in a gap between the brick chimney and the wall.

The failure of this wind bracing is directly related to the lateral movement of the top of the trusses towards the north that is being monitored by a plumb line. The roof decking is made up of one inch thick boards that are installed perpendicular to the roof purlins that span between the trusses. This system is not a rated diaphragm and provides only nominal lateral wind load restraint. This situation is an example of secondary building elements that are currently helping to hold this building together but normally are not permitted to be the primary structural system.

Is it reasonable and safe to continue to expose a large group of people to the significant risks associated with occupying this building? We think not. It would be difficult to defend the decision to continue to occupy this building if a collapse were to occur and people were injured or killed. The extent of deterioration of the main structural system of the roof framing and the known issues with the original design of bowstring trusses would lead reasonable and prudent engineers to not recommend continued use of this structure until structural repairs are made. To base continued use of the building on weather warning systems that require the evacuation of the building during what most people would consider only moderate winds, does not seem prudent in our opinion.

If you have further questions or would like additional clarifications of our opinions, please let us know.

Sincerely,

G. Craig Lee, S.E.
Principal