

REVIEW OF ZFA MAY 2017 LETTER AND REPORT, AND MURPHY 2017 LETTER:
Regarding Lum Elementary

In engineering there is more than one way to solve the same problem. The engineers picked by the district are using an ultra-conservative approach that will lead to the demolition and rebuilding of Lum, rather than working creatively to preserve the useful life of the facility. These latest letters and reports from ZFA and Murphy only serve to bolster the initial opinion letter issued by ZFA. These letters still do not provide us with ANY actual structural analysis, nor do they apply that structural analysis to any defined safety standards. The district should be directed to enlist the services of a "problem solving" engineering firm, like Smith Engineering, who specializes in retrofitting. Smith Engineering's approach is to keep the buildings and fix them in a cost effective feasible fashion. With that said here are some observations about the latest reports provided by the district:

ZFA Donald LUM ES Liquefaction Evaluation and Letter Dated May 2017:

This second "report" is still essentially an opinion letter, but with more words and diagrams. The one additional piece that has been completed since April 26, 2017 is an analysis of the foundations. There is a statement that the footings are not designed for the differential settlement predicted. It is accompanied by a number of equations and graphs that are not referenced anywhere in the 1/3 page "narrative". It is unclear if the conclusion is derived from any real analysis, or from opinion, as was true in the initial letter from ZFA. There is no mention about the structure above the footings. Footings don't cause risk to people, the structure above those footings is what may cause risk to people. Without an analysis of what happens to the structure above the footings there is no ability to assess risk or safety implications. The report does not answer the main concern: Will the structure above the footings collapse? This is yet another opinion, with more words and charts, provided to give credibility to the original letter but it only makes it more evident that they have not performed an structural analysis and evaluation of the buildings.

The 3 pages letter has 9 occurrences of the word collapse, even though there has been no structural analysis of the buildings. The collapse statements are still an opinion with no basis in analysis or modeling of the structure itself. The words "relatively" and "significant distance" are used without citing any code or provision to provide context. Apparently, if the differential settlement at Lum would be 4" instead of 7", we would not be having this discussion. The safety factors used in the prediction of settlement and minimum acceptable settlement are huge and depending on how they are computed they could position Lum in a clear safe zone.

ZFA states that a raft solution is not adequate, but they do not provide the analysis to prove this assertion. From Smith Engineering's review of the ZFA letter, ZFA used the wrong specs in running an analysis of the raft approach, and all it would take is a small modification to properly model the raft system and prove its viability as a solution. But ZFA is not looking for solutions, they are bolstering their initial opinion letter. A deep

foundation system seems to be their preference, contrary to what retrofit expert says is preferable. Deep foundations make the building stiffer during an earthquake preventing it from moving relative to the ground around it and resulting in rupture of gas, sewage and electrical pipes.

ZFA briefly mentions the connection of structural parts as a potential hazard for collapse but they do not provide any analysis of these parts and what their behavior will be in the event of settlement. They also do not consider all of the seismic improvement that have been made to Lum, including a new roof system that was installed in 2016 - which likely improved the joist and rafter connections that both ZFA and Murphy seem so concerned with.

Finally they state that a Field Act-compliant building build today would be safer than that built in the past. Based on this all buildings that are Field Act-compliant would have to be re-designed and re-built to keep up with the current engineering knowledge. This statement is baseless since Field Act-compliant buildings (old or new) have to guarantee the same minimum standards of life safety. All Lum buildings are Field Act-compliant.

Second opinion letter from Murphy Dated May 2017:

It is very hard for an engineering firm to issue a recommendation that is contrary to a previous recommendation to vacate a building. This new opinion was primed by the district by providing Murphy Burr Curry with the original letter by ZFA, rather than just providing them with the Geotechnical results alone. This clearly reduces the transparency of what should be an independent unbiased process.

With this in mind the new report suffers the same flaws as the original ZFA letter. Namely it has no structural evaluation to back it up. Thus the report is again just an opinion. Furthermore, the letter bases it's opinions on architectural renderings from 1959. There have been many seismic improvements at Lum since 1959, many of them within the last 27 years, but none of those improvements were considered. Namely, a new roofing system was installed in 2016 at Lum, likely improving the joist and rafter connections that both ZFA and Murphy seem so concerned with. No mention is made in either letter of these or any other improvements.

Loring A. Willie a world class structural earthquake engineer reviewed the reports provided by the district and he is recommending the board to not close the school until the district completes it's due diligence and actually COMPLETES a full structural n safety evaluation.

-Lum District Advisory Committee
May 19, 2017