Smith engineering, inc.

May 5, 2017 (r2 5/14/17)

Alameda Unified School District
c/o Facundo Del Pin
Lum District Advisory Committee
fdelpin@gmail.com

RE: Lum School Liquefaction & Settlement
1801 Sandcreek, Alameda, CA

Dear Mr. Del Pin:

Per your request, our office has conducted a cursory review of information related to potential site liquefaction during a major earthquake at the above-mentioned property. The purpose of this review is to provide an overview and opinion of the potential seismic performance of the subject school structure(s) located on the property and suggest a course of action in addressing these issues moving forward, including ideas for seismic strengthening of the foundation system. Neither a specific Code evaluation of existing plans nor a seismic analysis of the structure is part of this review.

Our experience in these matters is based on our design and construction oversight of 100's of seismic retrofits over the past 2 decades for various Bay Areas communities, including Alameda. Due to the short timeline given prior to the District making a critical decision to close the school, we'll also introduce other concepts that may need to be considered before proceeding.

In general, we agree with the geotechnical report prepared by Miller Pacific Engineering Group and its peer review (by RGH Consultants) in terms of anticipated differential settlement due to potential liquefaction. As most residents of Alameda may already know the South Shore area of Alameda is a landfilled section that was once part of San Francisco Bay.

Our concern is that a major decision to close the school is being made based on those reports and a single page engineering recommendation prepared by ZFA Structural Engineers. At this point, it seems prudent that a second opinion be sought for the structural engineer's report that includes ideas for what can be done to improve the seismic condition in consideration of various code standards, constructability, and feasibility. Based on the information available, this appears to not have been done yet, so any decision to close the school without understanding other options may be premature.

☐ BERKELEY OFFICE: 732 Addison Street, Suite B • Berkeley • CA 94710 • (T) 510.444.0494 (F) 510.898.1246
☐ GENERAL MAIL: Post Office Box 2329 • Berkeley • CA 94702 • info@smith-engr.com

In considering the ZFA engineering opinion report, the main question that needs to be posed to ZFA Structural Engineers is why they state that 'this new information will limit the work that can be performed to the existing buildings to that which is non-structural in nature'; what Code provision(s) are they referring too? This is the single-most important concept that should be fully understood before moving forward because it suggests that there are no other options except to close and replace the school, which would cost tens of millions.

Findings:

Generally speaking, the engineering premise is correct in that differential settlement can cause problems for buildings, even if not the primary life-safety issue. For lightweight and flexible structures, the amount of the differential settlement necessary to cause severe structural problems and/or be noticeable to the user can be more than expected depending on several factors. The potential for differential settlement (even if not attributed to liquefaction) is usually described within geotechnical reports, and often given as 1- 2 inches for typical soft-soil sites. For the Lum structures that are low, wide, lightweight (evenly distributed) and relatively flexible, if the foundations can be strengthened to minimize the effects of differential settlement to within typical anticipated deflection standards, the effects from differential settlement on the structure would be less severe.

Proposal:

The concern of liquefaction needs to be addressed. If the District choses to explore what it would take to design a retrofit for these buildings, it should focus on reducing the potential for differential settlement due to liquefaction.

We propose that a fast-track approach be taken to preliminarily determine a strengthening strategy that can be evaluated for feasibility, cost, and effectiveness. Then the District can make decisions based on all relevant information. Expediting a design option would demonstrate the District's due-diligence in this matter.

For soft-soil locations and lightweight structures, the potential for differential settlement is often mitigated with 'raft' or mat type foundations. Applying that concept to these buildings could be straightforward. If the perimeter sidewalks were removed around each building unit (or pod), the exterior of the foundations could be excavated to their full depth and an adjacent perimeter concrete grade beam installed. The new grade beam would be fairly wide and heavily reinforced to resist potential bending and torsion from differential settlement and building loading transferred through epoxy dowelled connections to the original foundations; a sort of circular raft. With each pod similar, design and detailing could be standardized with all work performed from the exterior, section-by-section to minimizing disruption to the structure. When the concrete is poured back in place of the sidewalk, it would look like nothing was done.

Overall site settlement will still occur in a big earthquake, but this kind of settlement would also be expected for surround areas, therefore these buildings may not necessarily

sink significantly more than adjacent areas, including neighboring streets and homes. With each pod symmetric in its plan and loading, there could be some minor residual 'global' differential settlement after a major magnitude earthquake that may prove hardly noticeable. Because of the open nature of the campus and surrounding parks, the Lum School could even continue to serve as one of the safe places for people to gather after a major seismic event.

If each pod is strengthened individually, only a few classrooms need to be displaced at any one time, and can be relocated to temporary portables in the rear area playground area.

This approach could be cost effective because of the repetitive and standardized nature of the work and materials. Therefore contractor know-how would only need to be basic, allowing for more competitive bidding as a shallow excavation foundation project. Because the work would be done from the exterior, there would be minimal disruption to finishes and operations.

If the District and DSA can allow for fast-tracking a preliminary design, the process could be done relatively quickly. However, the District would need to slow the decision process and create an opportunity to design and study a viable retrofit solution that could be ready to build during the next school year. With proper fast-tracking of the entire project, including financing and permit approval, work could start within the year, which should satisfy any notion of responsive action.

Conclusion:

The District may want to consider a 3rd option in their decision process. Many buildings are retrofitted because of their inherent value and necessity to the communities they serve. The information so far presented to (and by) the District tends to characterize this situation as a 'lost cause'. I would suggest that a more constructive approach be fully developed before closing the school. That may include new ideas from a different engineer.

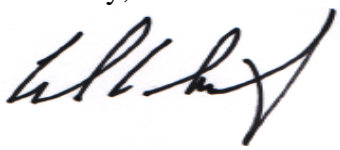
Limitations:

This opinion letter has been prepared for Lum District Advisory Committee and the Alameda Unified School District to be used solely for the consideration of the referenced property. The observations and summary represented herein are general and qualitative in nature and are intended as an aid in describing the overall structural systems of the subject building. The preliminary nature of these recommendations is not intended for construction. Our professional services have been performed with the degree of care and skill typical of the profession for similar circumstances, using reasonable diligence and judgment in the exercise of these professional services. The conclusions and recommendations as outlined above may be subject to revision as new information becomes available. Therefore, this report may contain insufficient information for the

purpose of other parties or other uses. No warranties, expressed or implied, are made as to the professional assessment and/or opinions within this report.

Please feel free to contact us if you have any questions or would like to discuss these ideas any further.

Sincerely,



Calin C. Smith, P.E.
President
Smith Engineering, Inc.

Cc: Joe Keiser - resiek@mac.com
Jim Gallagher - gallagher.jim.a@gmail.com
Kelly Scott - kellyjoscott@hotmail.com
Michelle LaFontaine - mlafon200@gmail.com