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Lawrence W. Gubbe, Ph.D., P.E.
President

April 19, 2016

Dr. Jaal Ghandhi, Chair
Department of Mechanical Engineering
University of Wisconsin
3107 C Mechanical Engineering Building
1513 University Avenue
Madison, WI 53706

Dear Dr. Ghandhi:

The purpose of this letter is to acquaint you with the activities of one of your professors, which if not tempered with reason, promises to have an adverse effect on the quarrying industry, not only locally but statewide. I am writing at the behest of Jon Halverson, the owner and operator of the Oak Park Quarry located near Deerfield, Wisconsin.

Specifically, Dr. Roxanne Engelstad, has spearheaded a campaign to convince Deerfield Township to pass an ordinance limiting the peak particle velocity (PPV) of vibration at St. Paul's Liberty Lutheran Church (Liberty Church) resulting from blasting in the Oak Park Quarry to a maximum of 0.12 inches per second (ips). One of the bases for this recommendation is that Liberty Church was constructed in 1851 and is of significant historical importance. In a presentation that she made at a public hearing before the Deerfield Township Board on March 29, she indicated that she believes that adoption of this ordinance by Deerfield Township would set a trend for the entire State of Wisconsin. At a meeting on April 11, the Township Board voted to establish the maximum allowable PPV at historic buildings to 0.20 ips.

I was not present at the meeting during which the Township Board established the maximum allowable PPV at historic buildings at 0.20 ips and; therefore, am not conversant with the basis for that ordinance. However, in her presentation on March 29, Dr. Engelstad cited three references as the principal sources for her recommendation, (CALTRANS, 2004), (Whiffin, 1971) and (FTA, 2004)¹. Only one of these references contains recommended limits for vibration caused by blasting. Specifically, CALTRANS (2004) presents guidelines for damage threshold criteria for three classes of historic buildings (CALTRANS, 2004, Table 19, pp 27). These are:

¹ See attached "Comments on the Public Hearing on Blasting at the Oak Park Quarry - Deerfield Township" dated March 29, 2016, by Lawrence W. Gubbe, Ph.D., P.E. for complete citations.

<i>“Extremely fragile historic buildings, ruins, ancient monuments</i>	<i>0.12 ips;</i>
<i>Fragile buildings</i>	<i>0.20 ips; and</i>
<i>Historic and some old buildings</i>	<i>0.50 ips.”</i>

Of these Dr. Engelstad placed Liberty Church in the most vulnerable category of “*Extremely fragile historic buildings, ruins, ancient monuments*” and recommended adoption of an ordinance limiting the PPV at Liberty Church to 0.12 ips which is consistent with CALTRANS guideline for this class of historic structures.

The other two references cited by Dr. Engelstad refer only to vibration caused by traffic, rail traffic and construction activities such as pile driving and the consolidation of soils with vibratory compactors. It is well known that vibrations generated by rail and highway traffic and construction activities are typically of longer duration and lower frequency than the transient vibration generated by blasting. It is also well known that long duration, low frequency vibration is much more likely to damage buildings, and for this reason the limits on acceptable PPV are generally significantly lower for vibration generated by traffic and construction than the acceptable PPV for vibration caused by blasting.

In addition to the references discussed above, Dr. Engelstad presented four examples of structures of historical importance for which relatively low limits (i.e., 0.08 ips to 0.12 ips) were placed on vibration generated by nearby construction projects. The examples cited are the stone masonry arch at the entrance of and the de la Montaña Mausoleum at the Cypress Lawn Cemetery in Colma, California, the Shiloh Baptist Church in Columbus, Ohio and the St. Louis, King of France, Catholic Church, St. Paul, Minnesota. Again, the source of the vibration to which these structures were exposed was pile driving and caisson construction and, in the case of the St. Louis, King of France church, rail traffic. None of these examples is applicable to the effect of quarry blasting on Liberty Church.

Furthermore, Dr. Engelstad showed several photographs depicting damage to Liberty Church, the associated Education Building and the church cemetery that she alleged were caused by blasting that took place at the Oak Park Quarry. I have not been allowed to conduct a visual examination of the buildings and, therefore, have not been able to ascertain the cause of all of the damage that Dr. Engelstad described. However, based on Dr. Engelstad’s photographs alone, I am able to ascertain that most of the damage depicted by Dr. Engelstad is typical of damage caused in this climate by naturally occurring forces associated with cyclic variations in temperature and relative humidity.

Apparently, the Township Board somewhat moderated Dr. Engelstad’s recommendation and decided that Liberty Church is a “*fragile building*” as defined by CALTRANS and adopted their ordinance accordingly. I have recommended that a qualified structural engineer, licensed by the State of Wisconsin and experienced in evaluating the effect of

vibration on buildings should examine Liberty Church and recommend the class in which the building should be placed and; therefore, the maximum PPV generated by blasting at the Oak Park Quarry that the building can safely withstand. To the best of my information, knowledge and belief, Dr. Engelstad is not a structural engineer nor is she a Professional Engineer licensed by the State of Wisconsin. And, Dr. Engelstad has apparently convinced the leadership of the church and the Township Board that examination of the building by an independent Professional Engineer is somehow unnecessary and undesirable.

Dr. Engelstad presented the misleading references and examples described above in a public forum at which there was no opportunity for rebuttal or clarification of the record. In addition, Dr. Engelstad has used her academic degree and position on the faculty of the University of Wisconsin to enhance her credibility in an area in which, based on her profile presented on the University of Wisconsin website, appears to be outside her area of expertise. If the public record is not corrected, and if she continues in this vein, she may be responsible for inflicting significant damage on one of the local industries that is necessary to build and maintain the infrastructure of the area.

Sincerely,

Lawrence W. Gubbe, Ph.D., P.E.
LWG/lwg

Enc. "*Comments on the Public Hearing on Blasting at the Oak Park Quarry*" March 29, 2016, Deerfield Township by Lawrence W. Gubbe, Ph.D., P.E.