

**George Paschalis**

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**From:** Paul G. Richards [richards@ideo.columbia.edu]**Sent:** Mon 11/24/2008 1:27 PM**To:** tzbsite@dot.state.ny.us**Cc:** richards@ideo.columbia.edu**Subject:** comment on TZ Bridge review**Attachments:**

from 2 Clinton Avenue, South Nyack, NY 10960  
November 24, 2008

Dear Sir or Madam,

I am writing to comment upon a specific technical issue that will at some point need to be addressed and resolved, in serious consideration of a replacement for the Tappan Zee Bridge. The issue may indeed have already been resolved, in which case I'd like to see supporting information.

This technical issue has arisen in presentations this year to the Bridge SAWG, and concerns the foundations for any replacement to the causeway section, and indeed for any section for which friction piling is contemplated (rather than supports that go down to solid rock).

In these presentations --- which, together with supporting technical reports that have been made available to me, I have found very informative and helpful --- the proposed replacement for the current set of more than 160 short (50 feet) causeway spans is a series of around 20 or 30 longer spans (about 300 feet), each of which is proposed to be supported by massive steel friction pilings of length around 300--350 feet, that are still not long enough to reach solid rock beneath the riverbed on the western side of the river.

With this background, at last I can state my concern. It is, that a state-of-the art technical study of the impact of a credible design earthquake be conducted, to assess the performance of such a foundation for the proposed causeway replacement. A study of this issue will need to reach conclusions on the likelihood of liquefaction of some or all components of the organic sediments and clays that comprise the environment of the proposed friction pilings. Obviously, if ground shaking induced by a credible design earthquake is long enough and strong enough to induce lack of functionality of friction pilings, the bridge could become unusable for a long time, and would essentially require rebuilding in a context that would include a serious lack of credibility by the general public.

It is my understanding that technical studies of this issue have already been carried out, in which the performance of a series of bridge spans for the causeway section were computationally modeled, and were found to perform satisfactorily when subjected to earthquake shaking. It is good that such work has been done. This is a subject where the devil is in the details, where the level of sophistication needed is very high, but where at present the level of sophistication of work to date is not evident. In the work done so far, I for one would like to know

- (a) what was taken as the input ground shaking (was it appropriate as a characterization of the credible design earthquake?),
- (b) what is known from drill cores about the propensity for liquefaction of the riverbed sediments, and

(c) what type of non-linear relationship between stress and strain and strain history was taken for the computer modeling done to date (did it include liquefaction phenomena?).

The presentation by Mr. Michael Anderson on November 21 2008, at a meeting in Rockland Community College chaired by Harriet Cornell, provided some information on this issue. To paraphrase his words, "Ove Arup has a fine reputation for this type of work. We've reached out to others here, independent experts, and if the need arises we'll go further." It is good that such a review by outside experts has been conducted. The issue is of sufficient importance that documentation of its conclusions, and their rationale, should be made available --- as was done recently concerning the reviews in 2005 and 2007 of rail and highway tunnel options. At present, on the information available to me as a member of the Bridge SAWG, and with no meetings between last April and last week, I have found the presentations on this issue somewhat tantalizing in that, although it is clear that good work has been done, I can't assess it thoroughly without knowing more detail. (The presenters on this subject are both both blessed and cursed by having to address SAWG members with extensive expertise on some of the relevant subject matter.)

The answers to (a), (b), and (c), above, will surely be needed at a later stage if green lights turn on, and plans to build a new bridge become a reality. But in my opinion these answers are needed now, since potentially they could become a show stopper.

My thanks in advance, for relevant information on (a), (b), (c) above.

Your sincerely,

Paul G. Richards,  
member, TZ Bridge SAWG