



NATIONAL SOCIETY OF
PROFESSIONAL ENGINEERS

BOARD of ETHICAL REVIEW

CASE REVIEW

Bridge Safety After Earthquake

Case No. 25-2

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Facts

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Engineer V, a licensed professional engineer with more than three decades of structural engineering design experience, is contracted by a state transportation agency to perform an immediate, initial assessment of the safety of a major highway bridge following an earthquake. The bridge is part of a critical route for disaster relief—connecting a regional hospital and multiple supply depots to affected areas.

Engineer V's initial visual inspection of the bridge suggests no catastrophic failures: no visible cracks in the main supports and connections and only minor surface damage. However, detailed structural analysis to quantify the bridge's load capacity (including non-destructive testing, material testing, and load simulations), which is not within Engineer V's scope of service, will need to be done, and take several weeks.

State agency officials pressure Engineer V to approve reopening the bridge immediately, citing urgent humanitarian needs. Relief trucks are rerouting around the closed bridge, adding four hours to deliveries of food, water, and medical supplies to affected areas. In strategy meetings, the Governor's office argues that continuing to keep the bridge closed is a public safety risk because it delays aid to thousands of survivors in affected areas.

Engineer V knows that hidden structural weaknesses could cause collapse, especially if aftershocks occur, but also recognizes the harm caused by delayed relief. Engineer V recommends the bridge be open but recommends weight limit restrictions and ongoing monitoring until a full structural analysis (by others) is completed.

State agency officials reopen the bridge but do not warn of or publish notice of weight limit restrictions. Engineer V learns of this but takes no further action as the scope of their contracted-for work has been completed and the state agency has hired another consultant, Firm Z, to complete the additional structural load rating analysis.

Questions

1. Was it ethical for Engineer V to prioritize disaster relief logistics over completing a full structural analysis to identify any latent defects in the bridge?
2. Was it ethical for Engineer V to authorize reopening the bridge under the condition of imposing weight limit restrictions while awaiting more complete testing and analysis?
3. Was it ethical for Engineer V to take no further action after learning that state agency officials reopened the bridge without notifications of weight limit restrictions?

Code of Ethics References:

- I.1** Engineers, in the fulfillment of their professional duties, shall hold paramount the safety, health, and welfare of the public.
- I.2** Perform services only in areas of their competence.
- II.1.a** If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.
- II.3.b** Engineers may express publicly technical opinions that are founded upon knowledge of the facts and competence in the subject matter.

BER CASE REFERENCES:

[BER Case 00-5](#); [BER Case 04-8](#); [BER Case 07-10](#); [BER Case 12-11](#); [BER Case 22-5](#)

Discussion

Professional engineers fulfill a vital role in society in providing assurance that the systems, facilities, products, and structures used by the public are safe and effective. This role is particularly significant when the engineer is called to assess possible damage to complex structural systems in the wake of a natural disaster, in this case, an earthquake. During the performance of such assessments, engineers are sometimes presented with situations involving an impact on the public health and safety and must decide, after identifying and understanding the situation, how far their obligation reaches in seeking corrective action.

The obligation of a professional engineer to take action when faced with a situation involving a direct threat to the public health and safety has been addressed by the Board of Ethical Review (BER) on several other occasions. Review of the cases decided over the years by the BER demonstrates a consistent approach regarding this fundamental obligation on the part of professional engineers.

[BER Case 00-5](#) illustrates how immediate road closure due to an unsafe bridge, competing assessments of damage, and resulting public outcry arising from inconvenience over a detour combined to create significant public safety challenges when addressing this type of situation. Engineer A was an engineer with a local government who learned about a critical

situation involving a bridge 280 feet long, 30 feet above the stream. This bridge was a concrete deck on wood piles built in the 1950's by the state, and it was part of the secondary roadway system given to the counties many years ago. Engineer A received a telephone call from the bridge inspector stating this bridge needed to be closed due to the large number of rotten pilings. Engineer A had barricades and signs erected within the hour on a Friday afternoon. Residents in the area were required to take a 10-mile detour. On the following Monday, the barricades were in the river and the "Bridge Closed" sign was in the trees by the roadway. More permanent barricades and signs were installed. The press published photos of some of the piles that did not reach the ground and the myriad of patch work over the years. Within a few days, a detailed inspection report prepared by a consulting engineering firm, signed and sealed, indicated seven pilings required replacement.

Within three weeks, Engineer A obtained authorization for the bridge to be replaced. Several departments in the state and federal transportation departments needed to complete their reviews and tasks before the funds could be used. A rally was held, and a petition with approximately 200 signatures asking that the bridge be reopened to limited traffic was presented to the County Commission. Engineer A explained the extent of the damages and the

efforts under way to replace the bridge. The County Commission decided not to reopen the bridge. Preliminary site investigation studies were started. Environmental, geological, right-of-way, and other studies were also performed. A decision was made to use a design build contract to avoid a lengthy scour analysis for the pile design. A non-engineer public works director decided to have a retired bridge inspector, who was not an engineer, examine the bridge, and a decision was made to install two crutch piles under the bridge and to open the bridge with a five-ton limit. No follow-up inspection was undertaken. Engineer A observed that traffic was flowing and the movement of the bridge was frightening. Log trucks and tankers crossed the bridge on a regular basis. School buses went around it.

Significant themes from [BER Case 00-5](#), which also are present in the instant case, include the emergency nature of the bridge inspection, public pressure against rerouting if the bridge is closed, and multiple damage assessments. Indeed, Engineer V may have been aware of [BER Case 00-5](#) when they performed the earthquake damage assessment. To the matter at hand, the facts of the present case indicate Engineer V's competence in such assessments. Further, public pressure arising from inconvenience/delay due to rerouting is a legitimate albeit secondary aspect of the earthquake damage assessment. Because roads are public systems, bridge closure would impact the public health, safety, and welfare, so by the NSPE Code of Ethics (the Code) Sections I.1 and I.2, this is an actual, real (negative) impact to the public that should be considered. Under the facts, the BER finds Engineer V's recommendation that the bridge remain "open with weight limit restrictions and performance monitoring" is a reasonable, balanced approach to the situation.

A second aspect of Engineer V's post-earthquake damage assessment is how to respond when they learn that the proviso for ongoing weight limit and performance monitoring has been ignored. [BER Case 12-11](#) introduced Engineer A who was a professional engineer employed by OPQ Construction. OPQ Construction was a construction contractor hired by the state department of transportation to inspect and repair a series of state highway and parkway "on and off" ramps. Commercial vehicles were not permitted on the parkway. Engineer A (12-11) was directed by his supervisor to design inspection and construction scaffolding for a noncommercial parkway cloverleaf ramp with limited height and width clearance. From his personal experience driving on the parkway to and from work, Engineer A (12-11) observed commercial vehicles illegally driving on the parkway. Engineer A (12-11) was concerned that the safety of inspection and construction employees (as well as others) could be endangered if one of these commercial vehicles passes by the proposed inspection and construction scaffolding.

In [BER Case 12-11](#), the BER found that Engineer A should immediately notify verbally (and in writing if necessary) Engineer A's immediate supervisor at OPQ Construction of the safety hazards to employees (and others) due to commercial vehicles passing by while inspection and repair is being performed on the ramps. The key takeaways are an awareness that members of the traveling public sometimes do not abide by or follow regulations, so it would be naive to presume full compliance with a justifiable-yet-onerous limitation on bridge traffic. When non-compliance happens, it is necessary for the engineer to report the matter.

[BER Case 04-8](#) and [BER Case 07-10](#) further amplify an engineer’s duty to report non-compliance in situations of potential harm to the public, health, safety, and welfare. In [BER Case 04-8](#), Engineer A was an environmental engineer who performs wetland delineation services on the client’s wetland site. A few months after Engineer A (04-8) completed the services, he drove by his client’s property and noticed that the client has installed a substantial amount of fill material on more than half an acre across a portion of the wetlands without any permits, variances, or permissions. The installation of the fill material was a substantial violation of the federal and state laws and regulations.

It is significant to note the facts of [BER Case 04-8](#) identified a serious, but not immediate, risk to the public welfare. In that case, the BER concluded that Engineer A (04-8) should have contacted the client and inquire about the actions the client took and pointed out the action is a violation of the law and identified the steps to be taken to remedy the violation or obtain a variance from the proper authorities. In this connection, the engineer should have advised that the remedial actions should be in full compliance with all applicable environmental laws and regulations, which may include the review of a licensed engineer. If appropriate steps were not taken by the client, Engineer A (04-8) then had an obligation to bring this matter to the attention of the appropriate authorities.

[BER Case 07-10](#) discusses a similar ethical situation, where Engineer A (07-10) designs and builds a barn with horse stalls on his property. Four years later, Engineer A (07-10) sells the property, including the barn, to Jones. Later, Jones proposes to extend the barn and, as part of the extension, removes portions of the columns and footings that support the roof. The changes

were approved by the town and the extension is built and a certificate of occupancy is issued. Engineer A (07-10) learned of the extension and is concerned that the structure may be in danger of collapse due to severe snow loads. Engineer A (07-10) verbally contacted the town supervisor who agreed to look into the matter, but no action was taken. In that case, the BER found Engineer A (07-10) fulfilled their ethical obligation by taking prudent action in notifying the town supervisor—the individual presumably with the most authority in the jurisdiction. However, Engineer A (07-10) should have also notified the new owner in writing of the perceived deficiency.

The above-cited cases provide helpful and consistent ethical guidance in the present matter. Engineer V demonstrates clearly possessing the expertise to render an opinion to authorize the reopening of the bridge (Code Section II.3.b). That Engineer V’s scope of work was limited to the initial, visual inspection does not change this fact. The pressure placed on Engineer V by state officials (including the Governor’s office) is a difficult situation to manage. Code Section II.1.a states “if engineers’ judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.” Engineer V’s recommendation to impose weight limit restrictions was in the spirit of promoting the safety of the public, but the facts are clear that such accommodation would only satisfy the obligation to hold paramount the health, safety, and welfare of the public *if* the weight limit restrictions and ongoing monitoring were faithfully and fully followed.

[BER Case 00-5](#) is relevant as the BER concluded “[f]or an engineer to bow to public pressure or employment situations when the engineer

believes there are great dangers present would be an abrogation of the engineer's most fundamental responsibility and obligation. Engineer A [00-5] should take immediate steps to contact the county governing authority and county prosecutors, state and/or federal transportation/highway officials, the state engineering licensure board, and other authorities."

Notwithstanding the fact that Engineer V completed their contract for the initial post-earthquake bridge inspection, when Engineer V learned the required weight limit restrictions and ongoing monitoring were not being followed, Engineer V was obligated to immediately notify

all pertinent authorities, in particular the entity(ies) that control the traffic over the bridge. [BER Case 22-5](#), discusses actions Engineer V may wish to consider after reporting to authorities. In [BER Case 22-5](#) the BER concluded, "[a]ny additional steps taken beyond the notification of appropriate authorities are not an obligation of [an] Engineer but rather a personal choice as a citizen, and should be taken with due consideration of the multiple stakeholders in this matter and the engineer's many ethical obligations. Clear reporting of unresolved public health and safety risks to "appropriate authorities" satisfies [an] Engineer's obligation to protect public health, safety, and welfare."

Conclusions:

1. Engineer V did not prioritize disaster relief logistics over completing a full structural analysis to identify any latent defects in the bridge, but rather *balanced multiple key considerations* of the matter. Engineer V's assessment approach was ethical.
2. It was ethical for Engineer V to authorize reopening the bridge under the condition of imposing weight limit restrictions while awaiting more complete testing and analysis.
3. It was not ethical for Engineer V to take no further action after learning that state agency officials reopened the bridge without notifications of weight limit restrictions.



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