Engineering Profession Must Re-establish Relationship of Trust Following Catastrophes

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Manoj Chopra
University of Central Florida, Manoj.Chopra@ucf.edu

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By Manoj Chopra
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This past month has been very disheartening for me as an engineer. A confluence of national events of catastrophic failures and stories of inadequate design decisions have shined a negative light on the profession of engineering.

This should never happen! This is another way of saying that we must design and build things in such a way that they don't fail. And under no circumstance should they ever cause a loss of life. The "factors of safety" that are put in place to ensure that do we not fail – either over time or suddenly – must be re-examined. We must not even come close to the cliff or work in the margins.

So what has happened to these bedrock principles of engineering design? We have seen two cases of dramatic failure of engineered systems in just the past month: a pedestrian bridge collapse at Florida International University in Miami and the blowout of a jet engine on a Southwest Airlines aircraft in flight.

Both of them have resulted in loss of life. And unlike the response to natural disasters such as earthquakes, hurricanes or sinkholes, these were preventable failures related to poor design or inadequate maintenance. The causes of these two failures are being investigated and reports will be released to provide us with insights to further improve future designs and processes. We are continuously improving as we understand our built infrastructure, but there is no margin of error to lower our guard.

For instance, it has been reported that the support under the FIU bridge during the construction process was moved to a different position to accommodate a difficult situation with the sidewalk below. This *may* have caused changes to the structure that reduced its strength. And why was the critical task of post-tensioning the structural systems being conducted with traffic permitted to flow under the bridge? Cars under the collapsed bridge had no warning and were crushed. This should never happen!

This was reminiscent of the failure of a hotel walkway in Kansas City in the 1980s, where a design change without a detailed review of its impact on structural behavior caused a

catastrophic failure. We must learn from the mistakes of the past and continue to guard against lethargy or, even worse, negligence.

In the example of the fatigue-related failure of a turbine blade inside the engine of the Boeing 737, the engine exploded and caused shrapnel to fly into the fuselage. A life was lost when a woman was almost sucked out of the shattered window in midair. They were not able to save her life. This should not happen!

We know that there are regular maintenance checks to study the condition of each of these components. The time duration between checks is determined based on the design life of these components and the need to evaluate the level of fatigue as these operate under very demanding conditions. While it is still early in the investigation, any findings that may indicate delays in performing such checks to "keep the planes flying" should be deemed unacceptable by the engineering community.

An important aspect of my life as an engineer is the trust that my profession has built with the community. A layperson must not worry about stepping onto an aircraft or driving over a bridge, or for that matter, drinking the water and breathing the air. We are the stewards of the public's trust and must always keep in mind the responsibility that comes with it.

It is now alarming that people driving our highways and under our bridges are looking for and reporting any and all visible cracks to the authorities and the media, thinking there may be structural problems. This crowd-sourcing of structural assessment is not the right direction forward. It may cause panic in the community due to false and unprofessional reports, and further degrade trust.

The profession of engineering must work hard to re-establish its historical relationship of trust and reliability and not give into the demands for financial benefits or expediency. The loss of life from a poorly designed component or structure is unacceptable to me and should be to each and every engineer.

This should never happen!

Manoj Chopra is a professor of civil engineering in UCF's Department of Civil, Environmental and Construction Engineering. He can be reached at Manoj.Chopra@ucf.edu.