Why Didn't They Just Close the Road?

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After the release of the National Transportation Safety Board (NTSB) report on the Florida International University (FIU) pedestrian bridge collapse,[1] many have asked, "Why didn't they just close the road?" While this article will not attempt to answer this event-specific question, we will provide the perspective of two former state bridge engineers (the authors) about their decision-making process when faced with similar challenges regarding whether to recommend closure of a roadway.

Our Preeminent Responsibility

As engineers, our first responsibility is to protect the public safety, health, and welfare. This is spelled out in most states' authorizing legislation that regulates the practice of engineering as well as in most engineering codes of ethics.

In 1914, the American Society of Civil Engineers (ASCE) adopted its first code of ethics to be used as a model for conduct for ASCE members. In the current version of this code, the first point under Canon 1 is the following statement:[2]

> *Engineers shall recognize that the lives, safety, health and welfare of the general public are dependent upon engineering judgments, decisions and practices incorporated into structures, machines, products, processes and devices.*

Assessing a Potential Closure Situation

As state bridge engineers, we both faced situations that required making the recommendation to close a given roadway or bridge due to findings from an in-service or construction inspection, or some other event, to ensure public safety, health, and welfare were maintained. When you are in that type of situation, bridge technical staff gather data and calculate scenarios:

- Let's look at what changed since the last inspection.
- Let's look at the plans and details.
- Let's look at the existing calculations.
- Let's make some new calculations.
- Let's use our manuals of practice to reevaluate the damage or deterioration.
- Have we looked at the distress and quantified the accumulated damage to the member(s)?
- What is the consequence of load exceedance?
- Is there public access on or below this bridge?
- Who owns the road on and/or below the bridge?
- Can the structural support system be changed—for example, by installing temporary supports—to mitigate the concern?
- Can traffic be shifted or loads reduced by a truck detour to temporarily mitigate the risk?

When you are in that same type of situation during construction, procurement managers and governmental legal counsel gather different types of data:

- Who has the contract authority to stop the construction?
- Was the contractor proceeding at their own risk?
- Can we suggest that the contractor close the project?
- Are you questioning the contractor's means and methods?
- What is the standard of care defined in the procurement document?
- Who owns this problem?
- Is the bridge fit for service, and can it meet its intended purpose?
- How is the insurance coverage addressed?
- How is the performance bond addressed?
- If this is a design-build job: Do we need to wait for others to propose the fix?
- If we do not own this problem yet, can we let their insurance carrier sort this out?

Sometimes, the engineers involved will conclude with complete certainty that the bridge needs to be closed because the engineering calculations and data clearly support that decision. Still, putting that decision into action isn't always as easy as it sounds.

Pushback

When making a recommendation to close a bridge, state bridge engineers inevitably hear the following types of objections from those around or above them:

- We can't close that road—10,000 vehicles per day use that facility.
- That's the only route to the school.
- That will create an hours-long detour.
- Closing the bridge will make us look like we don't know what we are doing.
- Commissioner So-and-so isn't going to be happy—that road is on his way home.
- We're likely to endanger more people with the traffic detour.

These objections are often followed by second-guessing:

- Aren't your capacity calculations always on the conservative side? Isn't there always more capacity than what we predict?
- Are we really going to see the live loads you used in your computations?

- Hasn't the structure been this way for several days, months, or years? Why close it now?
- We've had problems like this in the past and nothing bad happened. Why would we expect this to be any different?

In his October 28, 2019, concurring statement about the FIU bridge collapse (see the statement following this article), NTSB vice chairman Bruce Landsberg rightfully identified that the recommendation to close the roadway would have been an "unpopular step." Indeed, "unpopular" is probably an understatement at a time when most motorists expect to be able to go anywhere at any time with few impediments. In recent years, crashes involving 50 to 60 cars at a time during inclement winter weather illustrate this point.

For a state bridge engineer, advising the department of transportation (DOT) leadership that a major in-service roadway or bridge needs to be closed may even have career-limiting repercussions. That may be unfair, but the reality is you only get to go to that well so many times before you lose credibility. The traveling public and elected officials expect that the transportation owner will do everything in its power to keep traffic moving. Closing a bridge or roadway or shutting down a construction project is counter to that expectation.

Elected officials are often sensitive to how their constituents will react when their usual commute home from work gets disrupted by an unexpected transportation asset closure. DOT leadership can also be sensitive to the general message a specific closure sends to the traveling public: If this bridge had to be closed, what about other ones like it? These pressures are felt by everyone involved in these decisions. Ultimately, it is be better to be asked why you took preemptive action that might not have been needed, rather than trying to explain after a tragedy why you didn't; however, in the decision-making moment, this sentiment is of little consolation.

Who Makes the Call?

State bridge engineers typically do not have the direct authority to close any and all bridges in the state. The DOT may also lack the legal authority to close a bridge. Instead, this authority often lies with local law enforcement, local governments, or owners of the bridge. In these instances, the DOT must rely on these local officials or owners to take appropriate action.

Sometimes, convincing local officials of the urgency of the recommendations is challenged by their complacency or lack of understanding—"I drove over that bridge yesterday. What could possibly be wrong?" Instances like this call for strong leadership from not only the state bridge engineer but also those above the engineer in the chain of command.

Conclusion

As the recommendation for closure is escalated, the individual with the ultimate legal authority may be on the frontlines of a media firestorm when the closure is announced and implemented. To withstand this public scrutiny, the individual in charge requires not only courage but also complete confidence in the recommendation being brought to them by the state bridge engineer. While it may be a simple thing to say, "Just close the bridge," implementation of this decision can often be a challenge. Again, you only get to go to that well so many times.

References

1. National Transportation Safety Board (NTSB). 2019. *Pedestrian Bridge Collapse Over SW 8th Street, Miami, Florida, March 15, 2018*. Highway Accident Report NTSB/HAR-19/02 PB2019-101363. https://www.ntsb.gov/investigations/AccidentReports/Reports/HAR1902.pdf.
2. American Society of Civil Engineers (ASCE). 2017. Code of Ethics. https://www.asce.org/code-of-ethics.

EDITOR'S NOTE

The entire text of the concurring statement by NTSB vice chairman Bruce Landsberg (see pp. 106–107 of Reference 1) is reproduced below. The text has been reformatted from the report to fit the page.

National Transportation Safety Board (NTSB) Member Statement

Vice Chairman Landsberg filed the following concurring statement on October 28, 2019.

Concurring Statement of Vice Chairman Bruce Landsberg re Miami Pedestrian Bridge Collapse

A bridge-building disaster should be incomprehensible in today's technical world. We have been building bridges in this country for over two hundred years, and long before that in other parts of the world. The science should be well sorted out by now—and for the most part, it is. The investigation clearly highlighted basic design flaws and *a complete lack of oversight by every single party* that had responsibility to either identify the design errors or stop work and call for a safety stand-down, once it was clear that there was a massive internal failure.

The "what" is very clear but the "why" is more elusive. Despite the public's anger, distress, and disappointment, none of the responsible organizations had any intent for this tragic event to occur or to cause any injury or loss of life. Sadly, good intentions do not suffice for competence and diligence.

Engineering schools will use this as a landmark case study for years—and they should. The Engineer of Record (EOR) employed by FIGG Bridge Engineers, Inc., was experienced, but his calculations were erroneous. Reflection on this event should go far beyond merely a technical review. The checks and balances that were required by the Florida Department of Transportation (FDOT) and American Association of State Highway and Transportation Officials guidance and incumbent upon Louis Berger (LB), the peer-reviewing organization, were completely lacking. LB lowered their bid to review the project by 43 percent in order

to get the business, but also reduced the scope of the review. The reason given was there wasn't enough money in the project to cover their efforts. That's both disingenuous and unconscionable. It also was in violation of FDOT's requirement that there be an independent second set of eyes to review everything—not just what was economically convenient.

It is likewise incomprehensible and unethical that LB would even bid on a job for which they lacked the requisite qualifications. That FDOT, which was supposed to review the plans, did not know, or think to ask, about their qualifications is more than just an oversight. It's just plain sloppy. Ditto for FIGG. FDOT claimed a technical error on the FDOT website and then, after the collapse, fabricated a disclaimer that they are not responsible for the data that they post. That's unacceptable in my view—either ensure the information is accurate or don't post it.

The bridge was not properly designed, and there was no qualified oversight on that design. When the inevitable began to happen—a creeping, catastrophic material failure, nobody did anything, despite what NTSB Chairman Sumwalt accurately described as the "bridge screaming at everyone that it was failing." Why?

Once the cracking became evident, *not one of the organizations involved was willing to take the essential and unpopular step to call a halt* and close the road. This is similar to the circumstances of the space shuttle Challenger disaster where the decision was made to launch in extremely cold weather. The engineers recommended against it because the O-Rings that were critical to fuel system integrity would be operating outside their design parameters. Rationalization, optimism, and schedule pressure contributed to what has been described in management training circles as "Group Think." Strong and confident personalities persuade everyone that everything will be OK. Despite misgivings and technical expertise that advise against such action, the team moves forward as a group.

It appears that the same mindset was in play here, in every organization: FIGG, LB, MCM (the construction company), Bolton Perez (the engineering firm overseeing the bridge construction), FDOT, and finally, Florida International University. It also appears that every organization absolved themselves of responsibility by rationalizing that if the EOR says it's OK, it must be OK, and if anything bad happens—it's on him. That is not the intent of peer review or safety oversight, and certainly fails the system of checks and balances in place to prevent catastrophes like these.

We've learned this the hard way too many times in transportation modes. The NTSB's stated role is not to lay blame, but some would say that's exactly what we do when we apportion causation. The human failing that affects all of us is complacency. It is not a term the NTSB uses often, but in my opinion, it is present in nearly every accident and crash. We are creatures of habit, and when we become comfortable through long repetitive experience, the guard often comes down—periodically with disastrous results. This is precisely what safety management systems are designed to prevent—to trap errors in process before they become catastrophes. While disasters may be perfectly clear in hindsight, the best organizations take proactive measures—constantly. Schedule pressure, economics, overconfidence, and complacency all work to counter good intentions and too often create tragedy.

It is my fervent hope that the organizations involved will take the NTSB recommendations seriously and quickly implement them. The lives lost and the families disrupted deserve at least that much.