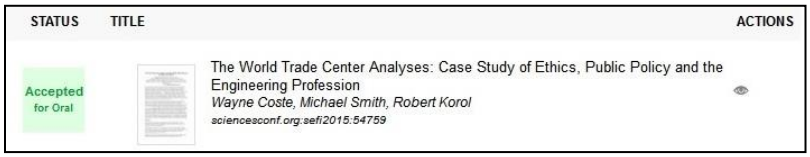

The World Trade Center Analyses:
Case Study of Ethics, Public Policy and the Engineering Profession

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INTRODUCTION

The engineering profession has the important role of bringing reality and credibility into public policy discussions. Historically, engineers have been held in high esteem because of the standards of excellence and ideals observed in the work of numerous individuals and espoused by their professional societies. With the array of challenges facing the world, such as global climate change and sustainability, the engineering profession must retain this stature so it can help build tomorrow's world. The preamble to the National Society of Professional Engineers Code of Ethics says:

"Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering … must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct [1]."

This case study will discuss the reasons that many in the public are questioning the integrity of the engineering profession. Large segments of the population in North America perceive engineering organizations and universities forfeiting their role by implicitly supporting implausible assertions about physics and engineering related to the destruction of the World Trade Center skyscrapers on 11 September 2001.

Given their commitment to ethics, the failure of the engineering profession to address the issues described in this case study is incomprehensible. While diversity in engineering education suggests that a multitude of perspectives can increase the

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ability to solve complex problems, diversity does not mean that selected engineering principles can be disregarded if they become a nuisance.

1 PERTINENT BACKGROUND

On the morning of 11 September 2001, the Twin Towers (North Tower, WTC1 and South Tower, WTC2) at the World Trade Center in New York City suffered structural trauma followed by fires. In less than two hours from the impact of the first airplane, both steel-framed structures were destroyed to their basements. At 17:20, the roofline of the 47-story World Trade Center Building 7 (WTC7), which was not hit by an airplane, descended symmetrically under free-fall acceleration for 32 meters in a manner indistinguishable from a classic controlled demolition where supporting columns are destroyed simultaneously with explosives.

In the years 2005 through 2008, reports were prepared under the National Construction Safety Team Act (NCSTAR). These reports covered the destruction of the Twin Towers (WTC 1 and WTC 2) and WTC 7. These investigations resulted in the publication of several NCSTAR reports by the National Institute of Standards and Technology (NIST) [2]. Footnote 13 of *NCSTAR 1* states that NIST's analysis would not attempt to explain the actual destruction of the Twin Towers, *"The focus of the Investigation was on the sequence of events from the instant of aircraft impact to the initiation of collapse for each tower. For brevity in this report, this sequence is referred to as the "probable collapse sequence," although it does not actually include the structural behaviour of the tower after the conditions for collapse initiation were reached and collapse became inevitable."*

Once these reports were released, they became the subject of much criticism from within the professional and scientific communities [3]. Numerous building and technical professionals have called for explanations of how NIST reached its conclusions. In the ensuing years, over 2,300 architects and engineers, verified and vetted, have signed a petition addressed to the members of the House of Representatives and of the Senate of the United States of America, stating that:

"On Behalf of the People of the United States of America, the undersigned Architects and Engineers for 9/11 Truth and affiliates hereby petition for, and demand, a truly independent investigation with subpoena power in order to uncover the full truth surrounding the events of 9/11/01 - specifically the collapses of the World Trade Center Towers and Building 7. We believe there is sufficient doubt about the official story and therefore the 9/11 investigation must be re-opened and must include a full inquiry into the possible use of explosives that might have been the actual cause of the destruction of the World Trade Center Twin Towers and Building 7 [4]."

The petition signatories represent many highly qualified, technical professionals. A debate challenge has been extended for equally qualified professionals to support the *NIST WTC7 Report* (*NCSTAR 1A*) in public on a shared stage. In the last year, not a single technical professional has expressed a willingness to publicly substantiate the NIST analysis.

Sound engineering analysis should, at a minimum, conform to the basic rules of observation. At a Congressional hearing, Glenn P. Corbett who served as a member of the Federal Advisory Committee to the NCSTAR process said, *"During the course of the WTC investigation, I have had serious concerns about some of the findings and conclusions that NIST has drawn. Other individuals, including some people on the Federal Advisory Committee, have also had concerns. I would suggest that a more formal mechanism be developed to officially address comments from the*

public. Such a protocol should include the technical basis for which NIST rejects or accepts the content of a public comment [5]."

During the only public comment opportunity for *NCSTAR 1A*, a question was asked by a member of the public that required NIST to acknowledge that WTC7 experienced free fall acceleration over a vertical distance of 32 meters. This free fall could only occur if all 24 interior supporting columns on each of the eight floors were destroyed simultaneously, which fire alone could not have accomplished. Even though NIST confirmed the observation of free fall in its report (Figure 3-15, *NCSTAR 1A*), the authors did not revise its engineering models to explain how the entire supporting structure suddenly offered zero resistance.

NIST refuses to release computer input data used in its analysis of WTC7, saying that if this information were to be released, it would *"jeopardize public safety* [6]." If NIST's analysis is technically accurate, engineers must have this information to design tall buildings and ensure "*the protection of the public health, safety, and welfare* [1]." Through Freedom of Information Act requests, information about flaws in the NIST analyses have been uncovered. NIST has acknowledged that flange stiffeners, critical structural elements whose absence is key to their failure hypothesis, were omitted from their finite element analysis. Three lateral support beams reinforcing the structure at the presumed point of collapse initiation were also omitted [7]. It seems likely that an open and transparent peer review process could invalidate the conclusion of a fire-induced, gravity-only collapse.

1.1 Engineering Curricula and the World Trade Center

What engineers are taught at universities about the "failures" at the World Trade Center affects the profession. Anecdotal observations of the authors suggest there are no publicly available text books or course notes that describe the collapse mechanisms from an engineering perspective to allow students to study and replicate those conditions. Open and transparent processes are a key part of a university education and are necessary for confidence in the education of engineers.

In our complex modern world, technical professionals are relied upon for accurate information. The public expects university faculty members and representatives of professional societies to be a trusted source of information because of their expertise and because of their codes of ethics-regardless of whether those codes are formal or informal. The inclusion of *ethics* at conferences such as this one highlights this commitment. The failure of faculties and professional societies to look into the issues raised by thousands of concerned citizens, including many of their own credentialed professional members, undermines the stature of the engineering profession.

A poll done in 2013 showed that 24 percent of 18-to-24-years-olds, the age range of engineering undergraduates, agreed with the statement "Explosive devices were used to bring down the Twin Towers in a controlled demolition," while only ten percent of those over age 55 agreed with the statement [8].

On an episode of a reality show, *King of the Nerds*, a game blogger named Danielle was the unlikely winner of a science-related competition that pitted her against a NASA engineer and three other contenders. The most intriguing aspect of her upset win was that she used "9/11 conspiracy" websites to outperform her rivals [9].

2 PEER REVIEW

If engineering faculties and professional societies cannot be moved to call for corrections to obvious flaws in reports, what forum can enforce integrity? The scientific, engineering and academic communities rely on the peer review process to

provide accountability and enhance the quality and integrity of the work product. The public expects that peer review of engineering analyses would ensure that conclusions are based on an accurate, transparent and ethical process. The open and transparent processes that followed other disasters such as the Grand Hyatt Skywalk disaster and the Space Shuttle Challenger disaster [10] can be contrasted with the insular process that produced the NCSTAR series of reports. With the *NCSTAR Reports*, the consequence of bypassing a broad peer review process was that reports with serious omissions and unsupportable conclusions were released. This tarnishes the credibility of the engineering community as a whole. A comprehensive peer review process would have increased the likelihood that the *NCSTAR Reports* would have upheld the ideals espoused by universities, engineering societies and expected by the public.

Researchers who have studied the history of peer review have observed that peer review has its deep origins in state censorship implemented through state-supported academies [11]. Even today, researchers may be overly mindful of issues that are sensitive to their funders. This mindfulness has the potential to stifle the scientific processes that have improved the lives of populations around the world. While modern professional codes of ethics anticipate that peer review has evolved beyond those historical roots, the track record of professional journals regarding the events at the World Trade Center suggests those historical roots are deep.

2.1 Experience With Published Peer Reviewed Journals

The reputation of the engineering profession has been harmed by the apparent failure of the peer review process in important journals. In the past we have seen the reputation of professions, such as medicine, fall because of the publication of flawed research. The purpose of the following discussion is not to specifically criticize one group of authors, but to discuss a published work that represents the engineering profession's sole published explanation about the mechanics of the World Trade Center destruction.

Professor Z. P. Bažant, a member of the civil engineering faculty at Northwestern University, wrote several papers, one of which was entitled *What Did and Did Not Cause the Collapse of WTC Twin Towers in New York* [12]. Several versions of this paper were published, including one as early as September 13, 2001 [13]. Even though this hypothesis has been the subject of great professional disagreement, an ASCE journal allowed discussion of Bažant's hypothesis only once in a "discussion and closure" section which limits the length and scope of a critique [14].

2.2 Observation in Conflict with Basic Theory

In engineering, mathematics is used to create an abstraction of the physical world. Formulas and equations that do not represent the problem under investigation are irrelevant. Therefore, as the foundational concept, if observations do not match the theoretical framework, then a reassessment of the theory is necessary. Figure 1 shows Bažant's foundational model illustrating how the top part of the Twin Towers (labeled as Block "C" which is structurally lighter) started at rest, accelerated downward crushing through the undamaged stronger structure (labeled "A") in what the authors call the "crush-down" phase without inflicting equal or greater damage to Block "C". However, once Block "C" reaches the bottom and encounters additional resistance, the "crush-up" phase then destroys the previously indestructible Block "C." A defined rubble pile within the footprint of the tower is hypothesized to result.

Figure 2 is a photo taken from a police helicopter that has been available for many years. It has been available not only to Bažant and his co-authors, and not only to

those that have peer reviewed this paper, but also to the general public which now questions the engineering profession. In this photo, it is not possible to see any portion of an intact structure resembling the Block "C" that was hypothesized as the central mechanism of destruction in Figure 1. From this photo the Twin Towers are being destroyed as material is being ejected perpendicular to gravity in all directions.

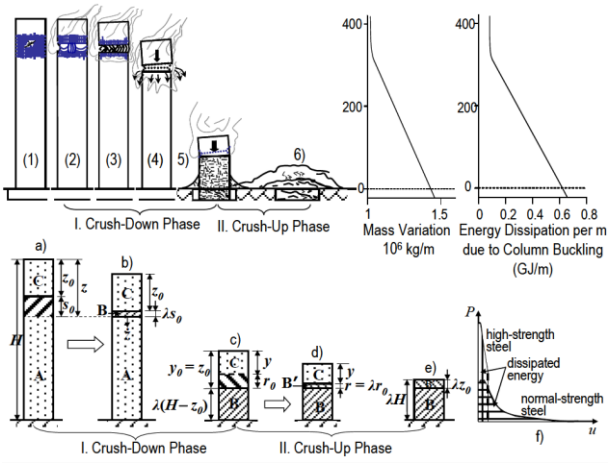

Fig. 1. Collapse Analysis Hypothesizing Free-Body "C" in Peer Reviewed Paper

Fig. 2. Observation of Collapse Lacks Hypothesized Free-Body "C" (WTC1)

From this single photograph, Bažant's hypothesis about Block "C" and the mechanism of destruction is invalidated. For the authors and reviewers of Bažant's papers to have accepted the hypothesized mechanism without reviewing the wealth of photographic evidence from the destruction of the Twin Towers demonstrates that the peer review process was flawed and this, from the public's perspective, discredits the engineering profession by extension.

If the Twin Towers did not crush themselves into a rubble pile during the crush-down phase as the Block "C" hypothesis suggests, where did the structural material and office contents land? Figure 3 taken from the 2002 FEMA report [15] shows that the material was ejected into two symmetric 370 meter diameter debris fields, each of which was centered on the footprints of each tower. Some estimates suggest that approximately 90-95 percent of the mass of the Twin Towers was ejected outside the footprint of the Towers leaving an insignificant rubble pile within the footprint. This would not have been predicted under Bažant's crush-down/crush-up hypothesis.

The absence of a significant rubble pile is an inherent part of the so called "Miracle of Ladder 6" story [16] which was one of the most recounted human interest stories following the Twin Tower's destruction. A segment from the 2002 PBS NOVA public television series, *"Why the Tower Fell,"* features interviews with a dozen members of Fire Department of New York (FDNY), mostly from Ladder 6, who were trapped in the fourth floor stairwell of the North Tower when the building was destroyed. After the destruction when the smoke cleared, they looked up and saw *"a beautiful blue sky above us"* – not the bottom of 106 stories of pancaked rubble.

In a photo taken two days after the devastation, Figure 4 shows the intact core columns that protected the fourth floor stairwell. They are rising above the lobby floor at the center of the North Tower inside the surviving east and north perimeter walls. Debris upon the lobby floor cannot be a rubble pile comprising the remnants of 106 stories of structural materials and office contents. These first-hand observations and photos were available to the authors, the peer reviewers, and the general public.

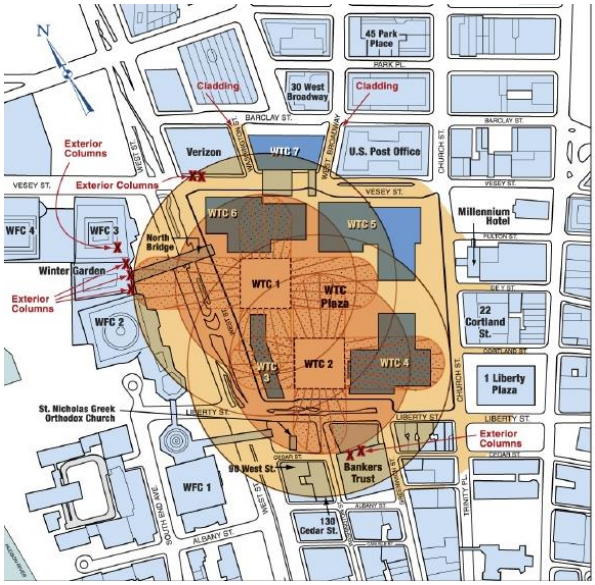

Fig. 3. Twin 370 Meter Diameter Debris Fields Centered Around WTC1 and WTC2

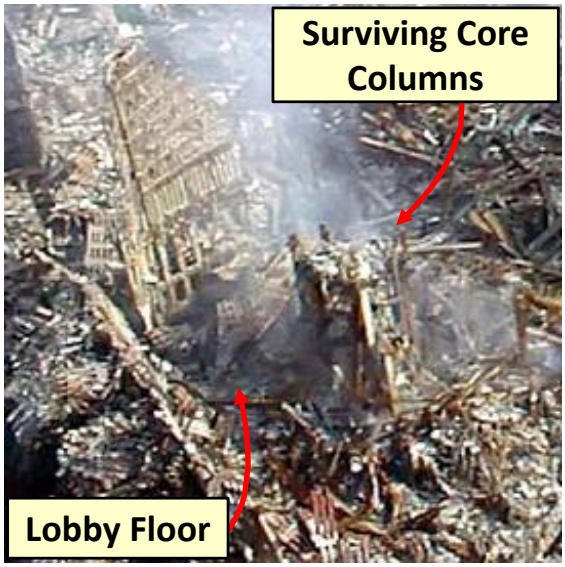

Fig. 4. Core Columns Surrounding the Stairwell Where Survivors Were Protected

3 EVIDENCE OF HIGH TEMPERATURE INCENDIARIES / EXPLOSIVES

Independent scientists and others, such as the RJ Lee Group and the United States Geological Survey (USGS) who examined the dust from the World Trade Center destruction, found an unusually high percentage of iron-rich micro-spheres. The formation of these micro-spheres requires temperatures higher than the melting point of iron or steel and therefore much higher than temperatures associated with the burning of jet fuel and office materials [17][18]. Subsequently, scientists found red-gray chips containing unreacted thermitic material in the dust. These chips were tested and shown to have explosive and incendiary properties [19]. The primary reaction product of these chips was shown to be molten iron. Molten iron from a thermitic reaction then dispersed during the energetic destruction illustrated in Figure 2 would solidify into iron-rich spheres similar to those found across lower Manhattan. Many people in the public know of this evidence and are dismayed that the engineering profession has not questioned the deficiencies in the Bažant hypothesis.

4 CONCLUSION

As one analysis of the WTC disaster emphasized, *"History shows that, with time, a given community of engineers and scientists has generally proven able to explain the technical particulars of a structural collapse ... By reviewing the history of disaster investigations in the United States, we therefore gain a broader context for understanding the early pitfalls and the future prospects for the World Trade Center investigation* [20]." The credibility and stature of the engineering profession to help build tomorrow's world may be severely weakened by these "early pitfalls" if they remain uncorrected. *"Most policies have a scientific and technological dimension and decisions must be supported by transparent, responsible opinions based on ethical research. It is therefore necessary to strengthen the ethical basis of scientific and technological activities …* [21]."

To uphold the integrity and ethics within the engineering profession, university faculty and professional societies across the globe need to support a broad-based peer review of the analyses and conclusions of the *NCSTAR Reports*. The erosion of confidence in engineers, engineering faculties, and engineering societies by the

public because of the ethical failures described here handicaps policy initiatives. Confidence is needed to create the sustainable world that a diverse engineering community must help build. Additional inquiry into the magnitude and extent of the erosion of the public's confidence in the engineering profession because of these issues would be a fertile area for research.

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