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LeMessurier Stands Tall: A Case Study in Professional Ethics

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EXECUTIVE SUMMARY

The practice of architecture can be extremely rewarding. But like any profession, the practice of architecture must include attention to a host of various business and legal issues. For many architects, dealing with the myriad of requirements and the complexities they impose can be challenging, and there is a related subject that is often overlooked – ethics. In most instances, sound business or legal decisions will also serve to fulfill one's ethical obligations. However, there are times when general business acumen will not serve to fully address ethical responsibilities or when ethical obligations dictate choices that are completely different than those from the business or legal perspective. It is in these situations that architects will be challenged to identify issues and formulate important yet difficult decisions that may serve to define one's practice.

The design of the Citicorp Center in New York City provides an excellent case study to analyze the competing demands placed on design professionals and to examine how business, legal and ethical responsibilities must be carefully considered and balanced.

INTRODUCTION

The Citicorp Center (now known as the Citigroup Center) is one of the most recognizable features of the New York City skyline.[1] The distinctive 45° angled top rises 915 feet into the air. The base of the building – arguably even more distinct – sits 114 feet in the air, supported by an unusual placement of four giant columns centered, not on the building's corners, but rather on each of its sides. These columns, or stilts, make the 59-story tower appear as if it is gracefully levitating above Lexington Avenue[2] and were anything but ordinary when they were first designed to support the then seventh tallest building in the world.

The story of Citicorp Center's structural engineer, William LeMessurier,[3] is instructive to those in the design industry. His innovative use and placement of those giant columns created a design marvel, but those very elements could have been the basis for a catastrophe of monumental proportions. Capitalizing on good fortune, the disastrous end of LeMessurier's career was avoided and, instead, his stature in the design professional community rose to new heights. His story demonstrates the need for proper communication, delegation and supervision during the design and construction process and emphasizes the importance of balancing professional and legal responsibilities with ethical obligations.

The Citicorp Center Design

In the early 1960s, Citicorp's headquarters, located at 399 Park Avenue in Manhattan, became too small for the company's ongoing growth and expansion. At the same time, St. Peter's Lutheran Church, constructed in 1905 and in need of serious repair without the funds to do so, began to consider selling its valuable property on the northeast corner of Lexington Avenue and 54th Street. As fate would have it, the church was located across the street from the bank's existing offices.

Citicorp spent five years and approximately $40 million to purchase all but one portion of the entire block.[4] The financial institution began planning to erect a new building on the church's block. But there was one important condition of the church's sale of its property to the bank: the bank would have to build a new church on the same corner of the block with no connection to the Citicorp building and no columns were permitted to pass through the new church to support the bank's building. The conditions imposed presented a significant architectural and engineering obstacle to constructing a well-designed high-rise building on the site, and required a team equal to the challenge.

In the early 1970s, Citibank retained Hugh Stubbins to be the architect of the new building.[5] Stubbins had started his firm roughly 20 years earlier and was experienced in designing high-rise projects. In fact, it was during the construction of Stubbins' first high-rise building – the State Street Bank Building in Boston – where his retention of, and relationship with, structural engineer William LeMessurier began. [6]

Like many stories involving design professionals, this one begins with a simple paper napkin. In a Greek restaurant close to his firm's offices in Cambridge, LeMessurier pondered how to overcome the restriction of placing one of the columns in the traditional corner location. The proposed solution he sketched on the napkin was a chevron pattern of structural bracing to transfer loads to columns placed at the mid-span of the building's exterior walls. LeMessurier's idea permitted each corner of the building to cantilever out 72 feet, which allowed Stubbins to delicately nestle the new church building into the northwest corner of the property while maintaining the use of the entire lot for Citicorp. The columns would act as stilts raising the building 114 feet in the air. [7] In addition to allowing the preexisting church to remain in place, the innovative design also left considerable open space at the ground level that enabled the height of the building to rise above what would otherwise be permitted by the zoning laws.[8]

Although the 160-foot angled top was originally conceived to face west and provide for residential penthouse setbacks, the City refused to grant a permit for residential use.[9] As a result, the configuration was re-oriented to the south to maximize the potential for generating solar power. Unfortunately, due to the lack of technological advancement of solar collectors at that time, the solar plan was abandoned. However, the unique angular top had become a signature of the design, and it was retained as housing for most of the mechanical equipment.

The Citicorp Center, completed in 1977, reportedly cost an estimated $195 million. At approximately 25,000 tons, the steel superstructure is considerably lighter than other skyscrapers of similar size. Due to the relatively light weight, building sway was a serious concern that LeMessurier addressed in the design phase. At the cost of $1.5 million, a "tuned mass damper" was installed in the angled top, the first of its kind implemented in the United States. This 400-ton block of concrete, which floats on a film of oil, is computer controlled to absorb the energy of the swaying structure and to reduce the building's wind-induced movement by as much as 50%.[10] At the time it was designed and installed, no one could have foreseen just how valuable the tuned mass damper might prove to be.

A Student's Inquiry

In June 1978, Princeton University engineering student Diane Hartley wrote her undergraduate thesis, "Implications of a Major Office Complex: Scientific, Social and Symbolic Implications" on The Citicorp Center.

In examining the structural engineering of the project in the preparation of her thesis, Ms. Hartley spoke to a junior engineer at LeMessurier's firm and requested the structure's plans and engineering calculations. She received the documents, and set about performing her own calculations – which indicated that quartering winds produced significantly higher stresses than those produced by winds hitting just one face of the building. This structural behavior was different from a conventional building with columns placed at the four corners, where wind perpendicular to one face presents the worst loading case.[11] As she reviewed the structural design, Ms. Hartley believed that it was not sufficient to withstand the quartering winds. She questioned LeMessurier's junior engineer about her findings, but was assured that the building was "more efficient" then her calculations suggested.[12]

Ms. Hartley submitted her thesis, which included both the inconsistency noted in her calculations, and the response from the junior engineer. She was not the only one to question the calculations. Her professor, David Billington, also questioned this inconsistency in his comments on Ms. Hartley's thesis.[13] In deference to the reputation and expertise of LeMessurier's firm, Ms. Hartley, an undergraduate student, accepted the response from the engineering firm.[14]

Years later, LeMessurier recounted that when he was first informed about the student's inquiry, he thought that the story would provide an interesting classroom lecture for his structural engineering class at Harvard University. Others say that LeMessurier's own dismissal of the significance of the quartering winds design condition encouraged him to revisit the issue. According to Robert McNamara, LeMessurier's partner at the time, LeMessurier had in fact considered the quartering winds during the design phase,[15] but determined that the quartering winds did not produce as much stress on the building as the perpendicular winds. The result was that the impact of the quartering winds was not closely analyzed since they were not thought to be the controlling design condition.[16]

LeMessurier passed away in June 2007, and never clarified what portion of the exchange between Ms. Hartley and the junior engineer was relayed to him. But this much is certain, the inquiry *was* relayed to him quickly and the inquiry piqued his interest. This may have been caused by a recent discovery he had made about his own design.

The Approved Substitution

In May 1978, only a month before Ms. Hartley raised her inquiry, LeMessurier was discussing two new skyscrapers slated to be constructed in Pittsburgh, PA. The design of the two buildings envisioned wind braces similar to the chevron pattern utilized at the Citicorp Center. One of the potential bidders for the Pittsburgh project raised a concern that LeMessurier's specifications required welded joints to the chevron braces instead of high-strength bolted joints – the welded joints were by comparison much more labor intensive and expensive. The bidder explained to LeMessurier that if bolted joints could not be substituted for welded joints, his firm might not be interested in moving forward.

It is unclear if LeMessurier knew, or even remembered that the request to bolt rather than weld the joints on the Citicorp Center had been approved by the design team. During the course of the Citicorp Center project, the steel contractor, Bethlehem Steel, proposed a substitution to the full penetration weld required in the construction documents. It offered Citicorp a $250,000 credit to use bolts instead of welds.[17] The substitution was accepted and the design team provided the design forces to Bethlehem Steel for Bethlehem's use in designing the bolted connections. Bethlehem's design was then reviewed and approved through the shop drawing process.

LeMessurier certainly knew of the substitution in June 1978 when he became aware of the student's inquiry. LeMessurier gave the issue serious thought and chose to further investigate. LeMessurier performed some preliminary calculations on the effect of the quartering winds and uncovered what he called "very peculiar behavior."[18] He found that in four chevrons in each tier, the diagonal wind stresses practically disappeared, while the stresses on the remaining four chevron braces nearly doubled.[19]

By itself, the doubling of the forces that the diagonals would have to resist was not a concern for the steel members.[20] Rather, the concern was that the bolts might not be strong enough to carry the imposed forces. LeMessurier later explained that "I didn't go into a panic over it, but I was haunted by a hunch that it was something I'd better look into."[21]

LeMessurier's Investigation

On July 24, 1978, LeMessurier traveled to his New York City office to carefully evaluate the impact of the substitution on the bolted connections. He found that the diagonal braces had not been treated as columns as he believed they should have been, but were, instead, treated as trusses. The force of wind against the building creates tension in the members as they resist the wind's efforts to topple the building. Since the building has weight, that weight (dead load) naturally counteracts the toppling force. Accordingly, the members need only account for the difference between the force resulting from the dead load (compressive) and the toppling (tensile) force. According to the American Institute of Steel Construction specifications in effect at the time, an engineer could only subtract three-quarters of the dead load force imposed in the columns.

However, in considering the diagonal bracing as truss members, LeMessurier's office incorrectly subtracted the entire dead load force. This relatively subtle difference resulted in half the amount of bolts that should have been used at each connection, which is equal to the same amount of bolts that would have been used if the diagonals were considered columns.[22]

The fact that the capacity of the connections was under-designed became even more troubling when combined with the failure to take into account additional loads due to quartering winds. LeMessurier calculated that the quartering winds increased the member stresses by 40%. As a result of LeMessurier's calculations, thoughts of a very realistic potential structural system failure and building collapse began to emerge.

On July 26, 1978, LeMessurier flew to Ontario, Canada to meet with Alan Davenport, a wind tunnel expert at the University of Western Ontario. Davenport modeled the building during the design phase and, at LeMessurier's request, retrieved his earlier wind modeling files. Davenport confirmed LeMessurier's fears and, worse, also opined that the increase in member stresses could likely climb higher than the theoretical calculations.[23]

At LeMessurier's request, Davenport provided detailed loading information on all of the structural members. LeMessurier's fears were confirmed: there was a major problem.

The Decision

Just two days later, on July 28, 1978, LeMessurier drove to his summer home located on a private island on Sebago Lake in Maine and spent the weekend analyzing Davenport's information to determine the full extent of the problem. LeMessurier's calculations revealed that 70 mph quartering winds would topple the building. According to the New York City weather records, the likelihood of a storm with 70 mph winds was one in every sixteen years. By taking the tuned mass damper into account, LeMessurier calculated that the probability of failure could be reduced to one in fifty-five years, but that assumed that the power to the building, which was needed to keep the tuned mass damper working, was maintained without disruption during such a storm.

LeMessurier evaluated his predicament. He would later recount that he figured he had three options: stay silent; commit suicide; or tell others of the problem. Despite articulating those options, other comments by LeMessurier made clear that he never seriously considered any option but the third.[24] He knew that disclosing the problem could lead to lawsuits, bankruptcy or possibly end his career, but LeMessurier believed his selfish worries were not enough to overcome his "social obligation." Indeed, in a videotaped lecture given at the Massachusetts Institute of Technology, LeMessurier discussed the ethical dilemma he faced and said:

> If you've got a license from the State and a certification from the University first and now you're gonna [sic] use the license to hold yourself out as a professional, you have a responsibility beyond yourself, if you see something that is a social risk…good heavens this thing would kill thousands! You must do something. You must do something.[25]

After deciding to act, LeMessurier developed his plan to fix the connections that same weekend. Fortunately, the diagonally bracing connections that needed retrofitting were located between the floors and were relatively accessible.[26] LeMessurier's plan not only included the work to the braces, but rather detailed the construction process so as to minimize the interruption to the employees in the building.[27] In a speech LeMessurier gave twenty years later, he explained that when he decided that he would inform Citicorp of the issue, he also needed to present a solution. "I had a scheme which I thought of before I opened my mouth. That's terribly important. You don't just cause havoc without having a solution."[28]

A Fortuitous Chain of Extraordinary Events

On Monday morning, July 31, 1978, LeMessurier attempted to contact Hugh Stubbins, but was unable to do so. Instead, he spoke to Stubbins' attorney (and his friend) and explained the issue. The attorney advised LeMessurier to contact his own insurance carrier before he told anyone else.[29] LeMessurier did as he was advised and contacted his insurer. The insurer appreciated the enormity of the situation and, the next morning, he met with lawyers appointed by his carrier in New York City. The team immediately made an important strategic decision by contacting Leslie Robertson, a structural engineer who had experience with both high-rise design and disaster management.[30] The lawyers met with LeMessurier and Robertson later that same day and, during the meeting, everyone agreed that LeMessurier and Stubbins should meet in person with Citicorp's chairman to inform them of this discovery.

At this point, Stubbins had no reason to believe that anything was wrong with the project. LeMessurier flew back to Boston that evening and met Stubbins just as Stubbins arrived home from a trip. LeMessurier informed Stubbins of his discovery, and Stubbins agreed to fly with him to New York the next morning to meet with Citicorp.

On August 2, 1978, LeMessurier and Stubbins attempted to meet with Citicorp's chairman Walter Wriston. They were unable to arrange a meeting with him and instead met with John S. Reed, who was then the executive vice-president.[31] Reed had an engineering background and had been involved in discussions during the project about installing the tuned mass damper.[32] LeMessurier explained the issue to Reed and how he believed it could be rectified. They discussed the estimated repair cost, and LeMessurier and Stubbins left the meeting with little feedback from Reed except that they should return to LeMessurier's office and await further instructions.

Two hours later, John Reed and Walter Wriston arrived at LeMessurier's office to discuss the predicament. LeMessurier recounted his sobering findings and the proposed solution to rectify the deficiency. According to LeMessurier, "Wriston was fantastic" and did not become adversarial. Rather, Wriston offered support in getting the remedial work done. Shortly after the meeting, LeMessurier's team arranged for emergency generators to be installed to insure that the tuned mass damper would remain fully operational even if power to the building was interrupted.

<u>The Remedial Work</u>

On August 3, 1978, LeMessurier and four associates met with Robertson and two Citicorp employees that were charged with overseeing the repair work.[33] LeMessurier explained his proposed design, which included welding two inch thick by six feet long gusset plates to more than 200 bolted connections. Citicorp approved the proposed design provided that the necessary materials and labor could be secured immediately. After some coaxing, Robertson was able to persuade Karl Koch Erecting to undertake the work, even though they were initially hesitant to do so because of commitments on other projects. Fortunately, Koch had the material on hand and agreed to start work once LeMessurier's office issued drawings.[34]

In addition to pushing the work forward as quickly as possible, LeMessurier and Robertson took several other critical steps to address the obvious safety concerns. First, they arranged to have the manufacturer of the tuned mass damper provide 24-hour service to insure no technical problems would cause an interruption in service.[35] Second, they placed strain gauges on several structural members so that the team could monitor the stresses imposed on the members. Finally, weather experts and forecasters were retained to provide weather and wind predictions four times each day.[36]

The Press (or Lack Thereof)

On August 7, 1978, LeMessurier's office issued the drawings for the repair work. LeMessurier and the team understood that, with the release of the drawings, a new element was about to be introduced into the very delicate situation. Up until this point, Citicorp, the design team members, Davenport, Robertson, the lawyers and the contractors were the only ones that knew about the existence of the problem. However, the drawings would have to be submitted to the Department of Buildings for review and permitting before any work could get underway, and consequently, the group of those with knowledge was about to greatly expand.

In addition, that same day, Citicorp and Robertson met with the director of disaster services for the New York metropolitan area of the American Red Cross to discuss formulating an evacuation plan.[37] The Mayor's Office of Emergency Management and the New York Police Department were included, and a plan was developed in case the predicted winds reached an unsafe level.[38] The evacuation plan included a ten-block radius, as the Red Cross estimated that 200,000 people could die if the structure collapsed.[39]

On the following day, August 8, 1978, Citicorp issued a bland, corporate jargon-filled press release that stated that the engineers had recommended strengthening certain connections of the wind bracing system. The Wall Street Journal quoted Henry DeFord, Citicorp's senior vice president, as stating that "engineers have assured the bank that the building isn't in any danger. The work is being done to anticipate the impossible that might happen."[40]

Later that day, LeMessurier and the team, along with the contractor, met with the Acting Building Commissioner, Blaise Parascandola, and nine other senior New York City officials to explain the reasons for the repairs and the solution contained in the permit submission. LeMessurier told the city officials that his own office was responsible for the predicament, but that the repairs would fully remediate the problem. LeMessurier's message was well-received by the City representatives. To the surprise of some, the City readily volunteered to do its part in assisting the effort. Concerned with a shortage of certified welders, the Department of Buildings offered one of the most trusted steel inspectors to provide testing and immediate certification of any welder that might be available to help with the repair work.[41]

The City's response was remarkable in some ways, but was not unique. Interesting insight is gleaned from Arthur Nusbaum, the project manager for the contractor for the original construction and the repair work. He remarked, "[i]t started with a guy who stood up and said 'I got a problem, I made the problem, let's fix the problem.' If you're gonna kill a guy like LeMessurier, why should anybody ever talk?"[42] LeMessurier's actions seemed to have commanded respect from all those involved.

Once the press got wind of the meeting with City officials, reporters gained a heightened level of interest in the proposed scope of work. However, Citicorp continued its efforts in downplaying the repairs by continuing to paint the news as mundane and not newsworthy. In a New York Daily News interview on August 8th, DeFord stated, "As it is, the building could withstand a one-hundred year wind…We are a very cautious organization – we wear both belts and suspenders here. We don't want people concerned, so we sent out a press release announcing the work."[43] Likewise the Acting Commissioner of the Department of Buildings stated in the same article "of course it's improbable, but there's always the chance of winds up to 150 mph, which…could break the bolts."[44] LeMessurier's handling of the situation with the City officials seemed to have created a fair amount of good will that became invaluable, especially in light of statements by City officials completely removing any notion that an engineering error was the cause for the repairs.

Later that evening, LeMessurier found out that a *New York Times* reporter had been trying to reach him all afternoon.[45] LeMessurier became concerned that an investigative reporter was insistent on attempting to reach him, and reluctantly returned the reporter's call that evening. Instead of having the dreaded conversation, LeMessurier was greeted by a recording indicating that a strike had just closed all of the newspapers in town.[46] Without newspapers, information dissemination in New York City skidded to a halt, leaving no one to question the repairs and the reasons for them.

The Weather Cooperates

Another fortuitous event came about a month later. August is hurricane season in New York. To retrofit the building in the most efficient way possible, LeMessurier prioritized every single connection, to insure that the welders were always working on the next most vulnerable connection. As welders raced to complete the welds, the temporary command center set up in Leslie Robertson's office was receiving terrible news about Hurricane Ella which had formed south of Bermuda on August 30th.[47] By September 1st, Hurricane Ella's winds reached 125 mph and was on a course to pass close to the Outer Banks of North

Carolina. While many people on the East Coast made alternate plans for what seemed to be a ruined Labor Day weekend, very few fully appreciated the devastation that Hurricane Ella held in its sights. The dreaded evacuation plan was hours away from implementation.

Then, as if Hurricane Ella was responding positively to LeMessurier's confession in much the same way as Citicorp, the City and the contractor had, it miraculously changed course and, unexpectedly, headed out to sea. With disaster avoided, welding continued and was eventually completed in October, just four months after receiving the student's phone call. The building now stands as one of the safest skyscrapers in New York City, able to withstand a 700-year storm without the aid of the tuned mass damper.

The Silence is Broken

With the exception of those involved, very few knew the real reason for the fixes to the wind bracing in 1978. But in May 1995, Joe Morgenstern broke LeMessurier's story in an engaging article published in *The New Yorker*. For almost 17 years, the story had remained hidden from the general public. Since then, many have viewed the actions of LeMessurier as nearly heroic, and many engineering schools and ethics educators now use LeMessurier's story as an example of how to act ethically.[48]

The Impact

While LeMessurier's initial estimate for the repair work was approximately $1 million, after the work was completed, he revised his estimate to be closer to $4.3 million. The contractor later reported that the construction work alone cost $8 million. While Citicorp never disclosed the actual cost of the remedial efforts, in some respects, it was not important. At the first 'settlement meeting' LeMessurier met with DeFord and Dexter, another Citicorp VP, without attorneys. While LeMessurier recounted that Citicorp pushed for a more significant contribution, at the second meeting with LeMessurier's attorney, Citibank agreed to accept the $2 million as full payment and agreed to seek nothing from Stubbins' firm.

An Analysis of LeMessurier's Acts

LeMessurier's story contains many interesting facets. Even though officials banded together, the weather held and the newspapers went on strike, LeMessurier's acts were remarkable. He has been both praised for his forthright honesty, and criticized for particular aspects of how he handled the situation. But LeMessurier's lasting legacy is one that challenges design professionals to stand tall behind their work – in good times and bad – and consider one's ethical obligations to be of the utmost importance. As he navigated this difficult course, LeMessurier compromised business and legal positions to act in accordance with his ethical obligations.

a. The Ethical Obligations

As is true for many professionals, rules of ethical conduct have been adopted to define the system of moral principles that architects and engineers are expected to follow. These rules are in addition to the legal obligations imposed by a particular jurisdiction. While LeMessurier, as an engineer, was subject to codes of ethics governing the conduct of engineers, those codes bear a close resemblance to those governing AIA members.

According to the Code of Ethics for Engineers issued by the National Society of Professional Engineers, six fundamental canons must be obeyed by engineers in the fulfillment of their professional duties. Engineers must:

1. Hold paramount the safety, health and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically and lawfully so as to enhance the honor, reputation and usefulness of the profession.[49]

b. Safety First

The most important point in each of the engineering codes of ethics is the responsibility of each engineer to "hold paramount the safety, health and welfare of the public."[50] While the AIA code does not specifically describe this obligation in the same way, the concept is fundamental to the profession of architecture. For example, in New York, the practice of architecture carefully describes professional services "wherein the safeguarding of life, health, property, and public welfare is concerned."[51] Similarly, in Ohio, the State's Code of Conduct applicable to architects states that the code of conduct is promulgated "in order to safeguard the health, safety and welfare of the public". [52]

In fact, Rule 2.105 of the 2004 AIA Code of Ethics and Professional Conduct goes further to require that if an architect becomes aware of a decision made by a client that adversely affects the safety of the public, that the architect must not only refuse to consent to the decision, but must also report the issue to public officials. There can be no doubt that safety comes first, and all decisions made by design professionals must be made with safety in mind.

While certain of LeMessurier's acts must be applauded, there are still some questions that have been raised by critics questioning whether LeMessurier acted with regard to safety first in all aspects or if a certain statement "suggests remarkable indifference to ordinary morality and fundamental misunderstanding of professional ethics."[53] The statement referenced above was one made by LeMessurier about Alan Davenport and his colleagues in Canada. LeMessurier recounted after the situation that Davenport and his team would keep "their traps shut forever" if LeMessurier decided against disclosing the situation – a statement that does seem to be at odds with the seminal cannon seeking to protect the safety and well being of the public.[54]

Even if LeMessurier had chosen not to disclose the predicament, any engineer with knowledge of the danger would have had an independent ethical duty to act. Certainly, from an ethical vantage point, sitting quiet forever was not an option, but even LeMessurier himself seemed to skirt that particular standard during a 1996 statement to an audience of M.I.T. engineering faculty and students. He stated that he knew of an important fifty-story building that was likely to collapse, "totally under-designed," but that he would not identify it. He continued in saying that "there are a lot of them out there."[55]

In LeMessurier's defense, these statements may have been made to illustrate the point that his decision to confess to the building's shortcomings was not a decision he was forced to make but, rather one he *chose* to make. In July 2007, ASCE addressed LeMessurier's conduct pertaining to Canon 1 in its regular column "A Question of Ethics."[56] The ASCE stated that LeMessurier had an ethical obligation to remove the safety threat, and he did. The round-the-clock repairs which had been verified by an outside consultant were appropriate, as were the efforts to arrange for emergency generators for the tuned mass damper and strain monitoring devices to read the buildings performance.

Certainly, one of the most important decisions that was made early in the process was to assemble a team that helped LeMessurier through the process. Any statements made later seem to have been overshadowed by the significant steps LeMessurier took to assure safety. Not to mention that a sophisticated and detailed plan to evacuate 200,000 people from midtown Manhattan was developed in conjunction with the City of New York and the American Red Cross. Just as remarkable as the creation of the plan, was the secrecy of it. In preventing public knowledge, LeMessurier's team prevented mass hysteria from causing its own safety threat.

c. Truthful Statements

According to both the NPSE and the ASCE Codes of Ethics, an engineer must "issue public statements only in an objective and truthful manner." Similarly, Rule 4.103 of the 2004 AIA Code of Ethics and Professional Conduct state that "Members speaking in their professional capacity shall not knowingly make false statements of material fact."

Whether LeMessurier complied with this obligation has been hotly debated. On August 17, 1978, the *Engineering News Record* reported "LeMessurier maintains that the...tower has well over the structural support it requires to withstand anticipated wind loads and that the purpose of the extra bracing is simply to supplement it."[57] The story went on to state, "LeMessurier declines to say, however, whether he feels the bracing is necessary or optional. 'I advised the bank, and they listened to me,' he says. 'As the bank put it, "we'd like to have belts and suspenders." While some question the complete truthfulness of these statements, one argument is that the truth of the statements made was 'close enough' under the circumstances. A videotaped presentation of LeMessurier made at M.I.T. on November 17, 1995 contains the following explanation:

> We had to cook up a line of bull, I'll tell you. And white lies at this point are entirely moral. You don't want to spread terror in the community to people who don't need to be terrorized. We were terrorized, no question about that.[58]

One might consider that by not alarming the public, LeMessurier was indeed acting in the public's best interest. Others, though, would argue that if there is a public danger, the public has the right to know. At a minimum, the statements clearly omitted relevant and pertinent information. Accordingly, it would seem that these omissions would fail to comport with Section II.3 of NSPE's Code of Ethics for Engineers requiring an engineer to "include all relevant and pertinent information" in statements made. But no ethics analysis is simple and NSPE Canon 4 requiring an engineer to be a "faithful agent or trustee" of his/her client might override any obligation LeMessurier had to say more.[59] Citicorp's desire to keep word of the massive repair out of the public domain was crystal clear. Accordingly, any consideration of LeMessurier's obligations under the third Canon must be considered with appropriate attention given to his duties to his client.

d. Silence

The sixth Canon of the NSPE Code of Ethics requires an engineer to conduct himself honorably, responsibly, ethically and lawfully so as to enhance the honor, reputation and usefulness of the profession. This requirement is mirrored in Canon I of the 2004 AIA Code of Ethics and Professional Conduct. Moreover, Section III of the Code of Ethics for Engineers clarifies that "engineers shall acknowledge their errors and shall not distort or alter the facts."[60] Additionally, Canon 7 of the ASCE Code of Ethics requires engineers to "provide opportunities for the professional development of those engineers under their supervision." Similarly, the NSPE requires engineers to "strive to serve the public interest" and are encouraged to provide guidance for young engineers.[61] These various provisions collectively develop the concept that a mistake such as this should be disclosed and discussed since it has significant value from the perspective of avoiding similar mistakes in the future. Some believe that since LeMessurier's personal memoir, published in early April 1995 (one month before the *New Yorker* article was published), failed to provide any description of the Citicorp saga or lessons learned from it, even though LeMessurier devotes significant attention to the Citicorp Project, it was not in keeping with his professional obligations.[62] Some criticize his silence.

Just three years after the Citicorp repairs were completed, the Hyatt Skywalk collapse took the lives of 114 people. If the structural problems of the Citicorp Center had been made known, one is left to wonder whether the Hyatt design team would have made the necessary changes to avoid the devastating events in Kansas City. However, based on a review of the Hyatt facts, it seems unlikely that knowledge of the Citicorp Center would have had any effect.

Unlike LeMessurier's willingness to question his own work, the Hyatt engineers did not appear willing to do so. Reports detail that before the Hyatt walkway collapse, contractors made complaints to the engineer about the walkways that the engineer summarily dismissed. Those complaints, if considered, would have alerted the engineer to the grave danger that existed. Moreover, the engineers failed to uncover shortcomings in their design process even after an unrelated collapse of the atrium occurred on that project.

While it is unlikely that the Hyatt disaster could have been averted by any events that occurred at the Citicorp Center, contrasting the two projects and the actions or inactions of the engineers provides invaluable lessons for designers to study.

Lessons Learned

a. Questioning One's Own Decisions

Diane Hartley, the Princeton engineering student, certainly deserves much credit for starting the incredible chain of events that may ultimately have saved thousands of lives. But her discovery would have never made a difference if it was not for LeMessurier's willingness to consider what others questioned. LeMessurier listened to the thoughts of an unknown college engineering student and intellectual curiosity and inquisitive nature prevented him from completely disregarding the student's inquiry. Instead LeMessurier considered the message from the student and questioned his own firm's design in an objective and thorough fashion.

LeMessurier's acts highlight the importance associated with constantly questioning and re-examining past decisions in light of new information or ideas. Design professionals must be open to other ideas, perspectives and criticisms while avoiding a "stubborn attachment to existing beliefs."[63]

b. Review of Changes to the Design

When a change from the original construction documents is contemplated, the decision to allow such a change must include the key persons involved in the design of the system. That should include the principal in charge, the lead designer, the project manager and the junior level person involved on the day-to-day work. LeMessurier's acts would not have been necessary if the substitution of bolted connections for welded connections had not been approved in the shop drawing process. The review process of accepting a substitution, or approving shop drawings, does not always receive the attention it warrants. This was especially true for the Citicorp Project where a local engineering firm had shop drawing review responsibilities and arguably, those that should have reviewed the submissions never laid eyes on them.

c. Perception

Regardless of how one views LeMessurier's particular actions, his personal attention to the issues coupled with the swiftness and definitiveness of his acts seemingly transformed a potentially divisive situation into one where he received the support of the client, governmental agencies and the contractors. Even if some of LeMessurier's acts arguably strayed from his ethical obligations, there seems to be equally plausible reasons to justify such conduct. Of critical importance, LeMessurier's acts and statements to Stubbins, Citicorp and the City officials, by all accounts, were perceived to be honest and professional. LeMessurier presented a problem, but, perhaps more importantly, he presented a detailed solution that everyone believed in. In the man's worst hour, LeMessurier's acts inspired those around him to come to his aid and support him. He was perceived by those involved as acting admirably and stepping forward to protect the safety, health and welfare of the public. Ultimately, it was the way the LeMessurier was perceived by Citicorp that saved him and his firm from the loss of his client, potential bankruptcy and a costly litigation. Ultimately, LeMessurier's ability to persuade Citicorp and the City Officials to stand behind him allowed LeMessurier to fulfill his ethical obligations and correct a mistake to avoid a potentially disastrous and deadly result.

Conclusion

In the words of William LeMessurier to his students at Harvard:

> You have a social obligation. In return for getting a license and being regarded with respect, you're supposed to be self-sacrificing and look beyond the interests of yourself and your client to society as a whole. And the most wonderful part of my story is that when I did it, nothing bad happened. [64]

Appendix A – AIA Code of Ethics

Appendix B – NCARB Rules of Conduct

Note: This paper was adapted from an earlier version co-authored by Timothy F. Hegarty.

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[1] "A tour de force as a stylish silhouette in the skyline and for the pedestrian, a hovering cantilevered hulk…" White, Norval and Elliot Willensky. "AIA Guide To New York City." Fourth Edition. Three Rivers Press. p. 281. (2000).
[2] The building has five massive columns, the fifth being located on the interior of the building at the elevator shaft.
[3] William LeMessurier (pronounced "La Measure") (1926-2007) was born in Pontiac Michigan. He graduated from Harvard with a degree in mathematics and went on to study architecture at the Harvard Graduate School of Design. In 1953 he obtained a master's degree in engineering from the Massachusetts Institute of Technology. He was awarded the AIA Allied Professions Medal in 1968, elected to the National Academy of Engineering in 1978, received and Honorary AIA designation in 1988 and an Honorary member of ASCE in 1989. William LeMessurier, Wikipedia. (accessed December 2, 2010.
[4] Alpern, Andrew and Seymour Durst. "New York's Architectural Holdouts." Dover Publications Inc. (1997).
[5] Hugh Stubbins & Associates was the design architect for the project and Emery Roth & Sons was the production architect. AIA Guide To New York City, *supra*.
[6] Morgenstern, Joe. "The Fifty-Nine-Story Crisis." The New Yorker. (May 29, 1995).
[7] A fifth stilt (or column) was located at the elevator core in the center of the building.
[8] Whitbeck, Caroline. "Addendum: The Diane Hartley Case." National Academy of Engineering. (January 14, 2011).
[9] Horsley, Carter B. "The Citicorp Center." http:/thecityreview.com/Citicorp.html. (accessed December 10, 2010).
[10] Gannon, Robert. "Buildings That Keep Their Balance." Popular Science (August 1985). It has been reported that the installation of the "tuned mass damper" saved the bank almost $4 million in additional structural bracing that would have been otherwise needed. The tuned mass damper is over 800 feet above ground level.
[11] LeMessurier, William J. "The 59 Story Crisis: A Lesson In Professional Behavior" (video November 17, 1995).
[12] This version of the events differs from those reported initially by Mr. Morgenstern in the article "The Fifty-Nine-Story Crisis" that appeared in the New Yorker on May 29, 1995.
[13] Interview with Diane Hartley, (February 2010).
[14] Whitbeck, *supra*.
[15] Kremer, Eugene. (Re)Examining the Citicorp Case: Ethical Paragon or Chimera. ARQ, Architectural Research Quarterly, V.6, Pt.3. pp 269-276. (March 24, 2003). Robert McNamara's statements directly contradict LeMessurier's statements that the quartering winds were not considered, and would not have been considered, since that was not part of the standard procedure at the time.
[16] It is also important to note that at the time of the design the New York City Building Code did not require an analysis of the quartering winds on a building.
[17] Kremer, *supra*.
[18] "The 59 Story Crisis: A Lesson In Professional Behavior," *supra*.
[19] "The 59 Story Crisis: A Lesson In Professional Behavior," *supra*.
[20] The diagonal bracing was comprised of W14x550 members.
[21] Morgenstern, *supra*.
[22] Four bolts had been used to secure each connection. Each bolt had a capacity of 100k and when the entire dead load reduction is used to calculate the force, 400K is the design strength needed at the connection. (2000K tension wind – 1600K dead load = 400K). However if the ¾ reduction was used 8 bolts would have been needed (2000K tension wind – ¾(1600K dead load) = 800K). Rodriguez, Vanessa. Citicorp Center. Penn State (2010).

[23] LeMessurier would later author a 30-page document entitled “Project SERENE – Special Engineering Review of Events Nobody Expected” which articulated the mistakes LeMessurier believed created the issue.
[24] LeMessurier did not think long about suicide, because “if I did I would miss finding out how the story ended…” “Fatal Flaw: A Skyscraper’s Nightmare. BBC/A&E. (documentary) 1996. “I had information that nobody else in the world had. I had power in my hand to effect extraordinary events that only I could initiate. I mean, sixteen years to failure – that was very simple, very clear-cut. I almost said, thank you, dear Lord, for making the problem so sharply defined that there’s no choice to make.” Morgenstern, *supra*..
[25] "William LeMessurier-The Fifty-Nine-Story Crisis: A Lesson in Professional Behavior" Online Ethics Center for Engineering 6/23/2006 National Academy of Engineering. (accessed February 1, 2011).
[26] Most were encased behind sheetrock.
[27] Plywood shacks were constructed within the office space around the weld sites to contain the construction activities.
[28] Montante, Ross. “Famous Engineer Shares Tale of Near-Disaster. The Chronicle March 10, 1998.
[29] Hugh Stubbins attorney was Carl M. Sapers, Esq. Morgenstern, *supra*.
[30] At the time, Leslie Robertson was probably best known for his role as the chief structural designer of the World Trade Center Twin Towers in New York City which had been completed in 1971,
[31] Morgenstern, *supra*. Reed eventually succeeded Wriston as chairman and served in that capacity from 1984 to 1998, and served as co-chairman from 1998 to 2000.
[32] Morgenstern, *supra*.
[33] Henry DeFord III and Robert Dexter were both vice-presidents with the bank and had overseen the initial building construction. Morgenstern, *supra*.
[34] Morgenstern, *supra*.
[35] MTS Systems Corporation was the firm that manufactured the tuned mass damper.
[36] Morgenstern, *supra*.
[37] Mike Reilly was the American Red Cross’s director of disaster services for NYC.
[38] Morgenstern, *supra*.
[39] Ramirez, Anthony. William LeMessurier, 81, Structural Engineer, Dies. New York Times. June 21, 2007.
[40] “Citicorp Tower Gets More Steel Bracing As Added Precaution.” The Wall Street Journal, p. 15, August 9, 1978.
[41] Morgenstern, *supra*.
[42] Morgenstern, *supra*.
[43] Martin, Joseph. “Citicorp Bldg. to Get 1M Wind Bracing.” Daily News. August 9, 1978.
[44] Kremer quoting Martin, Joseph. “Citicorp Bldg. to Get 1M Wind Bracing.” Daily News. August 9, 1978.
[45] Morgenstern, *supra*.
[46] Morgenstern, *supra*. The strike shut down the New York Times, the Daily News and the New York Post.
[47] National Weather Service records.
[48] E.g., Harvard; Texas A&M; and Online Ethics Center for Engineering, National Academy of Engineering.
[49] National Society of Professional Engineers, Code of Ethics for Engineers. An online version can be found at http://www.nspe.org/resources/pdfs/Ethics/CodeofEthics/Code-2007-July.pdf. Similarly, the American Society of Civil Engineers’ Code of Ethics contains seven fundamental cannons:

1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.
2. Engineers shall perform services only in areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.

Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision. American Society of Civil Engineers Code of Ethics. The ASCE Code of Ethics was adopted on September 2, 1914 and amended most recently on July 23, 2006. The American Institute of Architects, along with the other engineering societies also have codes of ethics. See e.g., ACEC Code of Ethics - http://www.acec.org/about/ethics.cfm; AIChE Code of Ethics - http://www.aiche.org/About/Code.aspx ; ASME Code of Ethics - http://files.asme.org/asmeorg/governance/3675.pdf; and IEEE Code of ethics - http://www.ieee.org/portal/cms_docs/about/CoE_poster.pdf .

[50] Id.

[51] New York Education Law § 7301 (stating" The practice of the profession of architecture is defined as rendering or offering to render services which require the application of the art, science, and aesthetics of design and construction of buildings, groups of buildings, including their components and appurtenances and the spaces around them wherein the safeguarding of life, health, property, and public welfare is concerned. Such services include, but are not limited to consultation, evaluation, planning, the provision of preliminary studies, designs, construction documents, construction management, and the administration of construction contracts.").

[52] Ohio Administrative Code §4703-3-07 (" Code of conduct. Preamble. In order to safeguard the health, safety and welfare of the public and the state of Ohio, to maintain integrity and high standards of skills and practice in the profession of architecture, the following rules of professional conduct, promulgated in accordance with Chapter 4703. of the Revised Code, shall be binding upon every person holding a certificate of qualification as a registered architect.)

[53] Kremer, *supra*.

[54] Kremer, *supra*.

[55] "William LeMessurier-The Fifty-Nine-Story Crisis: A Lesson in Professional Behavior," *supra*.

[56] "A Question of Ethics." ASCE Volume 32, Number 7. July 2007.

[57] Kremer, *supra*.

[58] "William LeMessurier-The Fifty-Nine-Story Crisis: A Lesson in Professional Behavior," *supra*.

[59] NSPE Code of Ethics for Engineers.

[60] NSPE Code of Ethics for Engineers, Section III.

[61] NSPE Code of Ethics for Engineers Section III.2.a.

[62] Kremer, *supra*.

[63] Roberto, Michael A. "In What You Don't Know: How Great Leaders Prevent Problems Before They Happen" Wharton School Publishing. (2009).

[64] Karagianis, Liz. "The Right Stuff." Spectrum. Massachusetts Institute of Technology. (Winter 1999).