My Obsession with Great Structures

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When I first joined the Society, I figured that I would have at least two years to prepare for my first paper. Much to my surprise, I didn't even get one full year. I pictured having something very clever, or intriguing. Well, as I began to think about what to do, I couldn't think of anything of the like. So as I searched my mind for ideas, it dawned on me that I needed to write on something that I am not, something that would stretch myself and help me learn about something new.

Since I am relatively new to the group, let me start out by introducing myself to those gentlemen that might not know me. I am not originally from Hopkinsville; I married into this town, in June of 1990, to a hometown girl Miss Charlotte Drury, otherwise known as one of the Drury kids from Drury Bros. on North Main. We married and moved from Nashville, to Charlotte, NC, where I worked as a Sales Representative for a Distributor of Packaging Equipment and Materials. Four years later, we moved to Atlanta, where I took on a new role for the same company. In September of 1998, I accepted the position of Sales Manager with Dunlap Sales, where I have worked for the past 10 years. Since then, I have held several different roles, including Sales and Marketing Manager, Director of Marketing, and now I am serving in my current role as the General Manager of our US, European and Asian Operations; with locations here in Hopkinsville, Witham, England and Shanghai China.

As you can tell from my current title I have done a considerable amount of travel over the last several years. I have been to most of the States in the US, the United Kingdom, Germany, the Netherlands, Japan, Taiwan, Thailand, Romania and China. Over my many travels, I have subconsciously been attracted or drawn to the tallest buildings in the area. As I began to prepare for this paper, I realized that I seem to have a slight obsession to great structures. I am fascinated with them, almost enamored by them.

In fact, now that I think about it, I grew up very close to two very large steel structures, probably in the top 100 in the world. I grew up most of my conscience life in Wilmington, Delaware, home of our Vice President-elect, Joe Biden, who by the way, gave the commencement address to my class at the University of Delaware, class of 1987. The first great structure is the Delaware Memorial Bridge, one of the largest suspension bridges in the world, totaling 10,796 feet, with the longest span of 2,150 feet, and with a clearance of 174 feet, connecting the First State, Delaware to the Garden State, New Jersey. This was built by the famous engineer, Othmar Ammann, who built other famous bridges like the George Washington Bridge and the Verrazano-Narrows Bridge in New York. The second structure is the Chesapeake Bay Bridge-Tunnel, also known as "one of the Seven Engineering Wonders of the Modern World"; rightly so, with a total length of 17.6 miles, consisting of 12 miles of low-level trestle, 2 one-mile long tunnels, 2 bridges, 2 miles of causeway, 4 manmade islands with an additional 5-1/2 miles of approach roads. This great structure connects Southeastern Virginia to the Delmarva Peninsula at the mouth of the Chesapeake Bay leading out to the Atlantic Ocean. I had the great pleasure of utilizing these great structures many, many times.

Then over my short career so far, I have been fortunate to visit many other famous structures including but not limited to: the Sears Tower and John Hancock Buildings in Chicago, the World Trade Center and Empire State Buildings in New York, Hoover Dam, the Koln Dom in Cologne, Germany, the Great Wall of China, and the 101 building in Taipei, Taiwan. Each structure was envisioned, designed and built by someone, which has always amazed me; I just cannot even imagine where to start, let alone how to even to take on such projects. It just isn't in my wheelhouse, and I am so impressed by people that can do such things. So think with me for a few minutes as I searched for the beginning of this magnificent art.

What is the fascination about building great structures, whether it be a huge bridge, or tall skyscraper or something that has never been done before? Maybe it is just in our human nature. If you look back into history, as far back as in the book of Genesis, after the Great Flood, the people decided to build a tower to reach into the heavens to help unite them as a people. It is recorded in Chapter 11:4 "Then they said, 'Come, let us build ourselves a city, and a tower with its top in the heavens, and let us make a name for ourselves; otherwise we shall be scattered abroad upon the face of the whole earth.'". So they built a tower, then according to the story in Genesis, God wasn't very excited about their motives and decided to shake things up a bit and made them speak many different languages, hence the name of this structure would be the Tower of Babel.

Not only did they seem to have God against them, which would be bad enough, but at the time, they were limited by the materials they used. Most of the great structures that I have mentioned are built from steel or iron, not from rock or

concrete, like The Great Wall of China or Hoover Dam; which are tremendous structures, but I want to focus my discussion to the tall iron or steel structures. So let's move many years forward, closer to our time. In fact, how about the 18th Century, say about 1779. This is when the English first used iron to build a bridge, obviously called the "Iron Bridge", a notable icon of the Industrial Revolution, and the beginning of when builders started to use this strong material.

Well let's move a little closer to our time, and across the English Channel to France, say about May 2, 1886. The French Government announced a contest "to study the possibility of erecting on the Champ de Mars, an iron tower with a square base, 125 meters on each side and 300 meters high", to be part of the Great Exposition of 1889, marking the 100th year anniversary of the French Revolution, and showing off to the rest of the World how technologically advanced this country had become. This is another example of how mankind tries to outdo one another, and tries to make a name for themselves.

The criteria for the contest were that the Tower would be self financing, and that it would be a temporary structure. It could be argued that it wasn't really a contest; well at least maybe not a fair contest. French Minister Edouard Lockroy rigged it, so that the "le Magician du fer" or the "Iron Magician", Alexandre-Gustave Eiffel would win. He presented the Minister with over 5,000 mechanical drawings representing over 18,000 different components prior to the contest. The Minister was so impressed that he made sure that Gustave Eiffel would win.

Eiffel seemed to deserve the award to build the Tower, given that the other 100 or so proposals wouldn't hold a candle to his great design and building plans.

Some of the other entries included ideas like a giant guillotine to mark the anniversary of their revolution, or a huge sprinkler that would be used to sprinkle the city during the summer drought season. His idea seemed to be the best of them all even without a little help from the inside.

Eiffel signed a contract with the French Government in January 1887, and broke ground soon after, on the 26th of the same month. The agreement was that Eiffel would contribute $1.3MM of the $1.6MM cost to build the tower, with the government subsidizing the rest. Part of the agreement was the understanding that Eiffel would receive all revenues generated by the Tower during the Exposition and up to 20 years thereafter. At that time, the government could tear it down or do as it pleased with the structure.

Alexandre-Gustave Eiffel was an amazing engineer and builder. He was a graduate of the Ecole Centrale de Paris, where he studied Chemistry. He would take advantage of his Mother's contacts and enter into the field of Metallurgy. He was married to Marie Gaudelet in July of 1860, after he built his first bridge, the Bordeaux Bridge. During their marriage they would raise three daughters, and two sons, and he would eventually start his own company.

Eiffel had a tremendous career and built many structures throughout the world including Spain, Portugal, Romania, Egypt, and Latin America, where he would build many different structures including: viaducts, bridges, department stores, banks, train stations and even the internal support structure of that great piece of sculpture by Frederic Auguste Bartholdi that commemorated the 100th anniversary of our Declaration of Independence, our Statue of Liberty. Eiffel even

designed a lock system for a failed attempt to build the Panama Canal. Towards the end of his career he would quit the construction business and would turn his energy to science where he would conduct hundreds of experiments, he would even build the first wind tunnel. He and I have a date in common; the last day of his life would be the same day of the month that would be the first day of my life, December 27th.

Most of these projects were successes, with the Tower being one of Eiffel's greatest accomplishments; and with good reason. He obviously learned a great deal about materials and construction techniques in the 30 years from the start of his career to the groundbreaking of the Tower. This Tower would be the first structure of its kind that would be built of iron, puddled iron to be exact. This particular iron has a high level of carbon, which gives it a high amount of tensile strength to be able to withstand the forces of nature. In fact, iron is 10 times more resistant than wood and 20 times more resistant than rock. This would be the first iron sky scrapper, twice as tall as the tallest structure at the time, the Washington Monument and it would continue its reign as the tallest structure until about 1930 when the Chrysler Building in New York was built.

Eiffel had building with iron down to a science. Of the 18,038 iron parts used in the construction, most of them were pre-fabricated off-site, where the rivet holes were even pre-drilled to a tolerance of 1/10 of 1mm. Which by the way, he used 2.5MM rivets in the construction of the Tower. He didn't even allow any girder to weigh more than three tons, which was all part of his remarkable plan.

Joseph Harris writes in his book, "The Tallest Tower": 'Eiffel had learned that using small components was faster and safer, even if this method did require more riveting, for cranes could be smaller and more mobile. The chances of accidents were reduced, and if one did occur the consequences were less serious. Use of bigger girders would have slowed the entire operation and would have required more expensive and complicated construction methods'. It was certainly a safe environment, with only one recorded fatality, of an assistant riveter; one of the 132 men on site and over 100 men off-site.

The four pillars or feet each positioned pointing exactly north, south, east and west, was built separately and didn't join together until they reached the 180 foot level. They had to be perfectly horizontal; otherwise it might have been called the Leaning Tower of Eiffel. To ensure this, he even designed and constructed hydraulic pistons that would be placed under each foot, so that he could make the proper adjustments to the height of the pillar. Incredibly, the biggest adjustment he had to make to one of the pillars was only 2-1/2 inches.

Where there was some difficulty with assembling the first floor, they were able to again utilize hydraulic jacks, along with a scaffolding system with a number of boxes of sand that were emptied to regulate the slant of the truss frames. Then the second floor was build using cranes that used the same route as the elevators, where the small pre-fabricated parts were assembled like a huge Meccano® set. This was another reason for the speed and precision of which the tower was constructed. In fact, not only was the tower completed ahead of schedule, it was completed under budget; something that seems to be unheard of in our time.

The Eiffel Tower has been a money maker for France. Over 2MM people visited during the Exposition, and paid 2 French Francs to go to the 1st floor, and 5 Francs to go to the very top. Now the Tower will have over 6MM visitors per year and they will pay €12.00 or about $15.00 at today's exchange rate to make the same journey. Eiffel was able to recover his investment within the first six months, and I assume that the French Government has been able to maintain a profit with the current estimated annual revenues of $90MM or so, not including the revenues from the souvenir shops and restaurants.

Everything didn't go as smooth as you might think. There was tremendous opposition to the building of the Tower. According to the book, "The Controversy about the Eiffel Tower" by Karen Plumley, many citizens didn't approve of the structure, including a group of 47 self proclaimed defenders of the city's cultural standards who believed the Tower would make Paris and its residents the laughing stock of the world. They had such descriptions as: "a belfry skeleton", or "a truly tragic street lamp". Even the French Prime Minister Triad opposed it, but he would later award it with the Medal of the Legion of Honor. The author of the novel "The Necklace" was said to have frequently dined at the restaurant on the second level so that he wouldn't have to see the Tower.

Like other great structures, the Tower too has brought out its share of crazy people. In February 1912, a tailor unsuccessfully attempted to fly from the first level aided by a homemade parachute type garment. In March 1984 an American pilot flew a Beechcraft Bonanza between the pillars, which when asked why he did it, he responded, 'it was just for fun'. And the Tower was even sold to a scrap

dealer by Mr. Victor Lustig a Czech-born con artist who had many aliases, but was best known as the "man who sold the Eiffel Tower". These are just a few stories of the many different events to take place on or around the Tower.

Unfortunately, the Tower, like many other structures of its kind, was used by people to take their lives. There have been an average of four people per year that have committed suicide using this grand structure. Ironically, I have firsthand knowledge of this practice at some of the structures that I have mentioned tonight. At the time that I had left the great state of Delaware in 1987, there had been 51 people jump from the Delaware Memorial Bridge, 50 of which died. The 51st person to jump was a classmate of by brother, and unfortunately, his father and brother were among the 50 who perished, but he was the one that lived. I don't remember his real name, but do remember my brother referring to him as "Splash".

Another incident, involved the Hoover Dam. While attending a show in Las Vegas a few years ago, I was able to finish setting up late in the afternoon, so a colleague and I made the one hour drive south so that I could see this incredible structure, a place that I had watched the documentary about it so many times on the History Channel. We were able to reach the Dam before it closed, only to be turned away because there had been an accident on the spillway side of the dam. We wondered why there was a car parked in the middle of the dam with the driver side door open. After talking with the Security Guard, which by the way had a connection to Hopkinsville, I found out that this is a common occurrence.

And lastly, my wife Charlotte and I went to New York to attend the US Open Tennis Tournament in September of 2001. While there, she and I made a trip to

the top of the Empire State Building where she took my picture with the World Trade Center in the background, exactly two weeks before the horrible act of terrorism on September 11th.

I want to close by bringing you from the late 19th century, to the present. Many structures have been built that dwarf the Eiffel Tower, but we all now could argue that Gustave Eiffel was the one person who started the Modern Day obsession with building the tallest structure in the world. As the year 2010 approaches, in just 513 days from today, there is going to be another world fair. This one is to be held in Shanghai China called Expo 2010, put on by an organization called the International Exhibitions Bureau, which was established in non-other-than Paris, in 1929. It is an organization that was put into place to regulate the frequency and quality of exhibitions falling within its remit. This is the same group that started the exhibition that the Eiffel Tower was built for in 1889.

You will be able to see Shanghai at its best with this exhibition's theme of "Better City, Better Life" and its Sub-theme of Blending of diverse cultures in the city, Economic prosperity in the city, Innovation of science and technology in the city, Remodeling of communities in the city and Rural-urban interaction, with a goal to attract the participation of 200 countries and international organizations and 700 million visitors. Shanghai, like France in 1889, is planning on wowing the world with their city.

Let me give you a little preview. If you haven't been to Shanghai, I am sure that you have seen pictures on TV or elsewhere of what I would call their Eiffel Tower. In Mandarin it is called the Dung Fung Ming Zhu or translated into English,

the Oriental Pearl otherwise known as the TV Tower. It antennae or spire reaches 468 meters tall and will be located just north of the Expo. It will be part of an amazing postcard that includes two of the tallest buildings in the World, the Jin Mao Tower standing tall at 88 floors, at a height of 421 meters, or 1,380 feet. It houses the Grand Hyatt where the lobby starts at the 54th floor. And, then there is the newest addition to the skyline, the Shanghai World Financial Center. It also houses another Hyatt Hotel and is the second tallest building in the world but tallest by roofline, at least for now, standing at 101 floors, at a height of 492 meters, or 1,614 feet.

These great structures are in the Pudong section of Shanghai, or east side of the Huangpu River, where the Chinese government will have moved an entire shipping port, and have torn down every factory or building in the 5.28 square mile area of the Exhibition which will be on both sides of the river in between the Nanpu and Lupu Bridges; which are sites to see themselves, in order to make room for their opportunity to wow the world.

So as we watch Shanghai prepare itself for this Expo, and as we watch as they build themselves a city, a tower with its top in the heavens, and make a name for themselves, I will leave you with this quote from Gustave Eiffel when he was defending his design of his tower and as we watch other buildings in Chicago, Moscow or Dubai get constructed, all vying for the title of the tallest structure in the world:

> "I will tell you all that I think and all that I hope. For my part, I believe that the Tower will have its own beauty. Do people think that

because we are engineers, beauty plays no part in what we build, that if we aim for the solid and lasting, that we don't at the same time do our utmost to achieve elegance? Are actual conditions of strength not always compatible with the hidden conditions of harmony? The first principle of architectural aesthetics is that the essential lines of the monument should be determined by it fitting perfectly into a setting. But what condition did I need to address in the case of the tower? Resistance to wind? Well, I maintain that the curves of the four groin vaults of the monument, based on calculations, starting with the enormous and unused footing at the base, are going to taper up to the summit, will give a great impression of strength and beauty, because they will convey to the eyes the boldness of the conception in its totality. Similarly, the numerous empty spaces that are part of the plan, part of the very element that go into the construction, will bear strong witness to the constant concern of not uselessly sacrificing to violent thunderstorms surfaces that pose a danger to the stability of the edifice. What's more, there's an attraction in things colossal, a special charm to which theories of ordinary are hardly applicable. Will we maintain that it's because of their artistic value that the Pyramids have so fired the imagination of men? After all, are they anything other than artificial hillocks? Yet what visitor remains unmoved in their presence? Who has not returned from them filled with admiration that is irresistible? And what is the source of the admiration, if not the immensity of effort and the grandeur of the result?

The Tower will be the highest edifice ever raised by man – will it not therefore be grandiose as well, in its way? Why would what is admirable in

Egypt become hideous and ridiculous in Paris? I've sought an answer, and must confess have found none."