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Structural design of both building and bridge structures entails a complex understanding of aesthetics, innovation, efficiency, and economy. This understanding combined with creativity and passion is at the heart of advancements in structural design. The area of concern which interests me is the harmony of innovative, aesthetically pleasing architecture with structural soundness.

During my high school years, I took a course called *Principles of Form and Design*, which focused on the artistic form that is present in various buildings and structures. In the class, we were encouraged to utilize our creativity in combination with our knowledge of aesthetic forms to design and sketch concept structures. I became exceedingly interested in the aesthetic forms which these structures presented. This art form of creating an aesthetically beautiful structure while maintaining structural soundness greatly intrigued me.

Because of my fascination with the aesthetic qualities that certain structures exhibit and my lack of knowledge of structural design at the time, I appropriately chose to study Structural Engineering in college. I began to learn about structural design and the importance of efficiency and economics. A few summers back I had the opportunity to intern at a Bridge Engineering company where I was exposed to the design and development of bridge construction which fueled my desire to learn more about the creative aspect which goes into structural design.

During my junior year, I became increasingly knowledgeable on the subject of structural design and the calculations and precision which it entailed. I had a strong desire to relate these technical items to the aesthetics of building and bridge design. I began to understand the great importance of aesthetics in structural design. After expressing this desire to my Civil Engineering Advisor, he offered me a unique opportunity of doing intensive research which focused on an “engineering analysis of engineering function”. The goal of this research was to work with my civil engineering professor, in addition to a licensed architect, to create a new course at my college, called *Structural Art*. Over the summer, I focused my research on wind effects on structures, earthquake analysis, and structural dynamics/vibration. I worked on developing the course content which related structural engineering to architecture, with emphasis on “form follows function.” The textbook which was to be used for the class was The Art of

Structural Engineering, written by Professor David P. Billington of Princeton University. The three elements in which Billington was most concerned with, and which the course focused on, were elegance, efficiency, and economics. The course explored various structures, each of them focusing on these three areas. Over the summer I created technical presentations which I personally taught during class in the Fall Semester. The presentations concentrated on wind and earthquake analyses, as well as structural dynamics. My first presentation outlined these complex concepts of wind, earthquake, and vibration effects. This presentation introduced the concepts which were vital to understanding the other topics. The four following presentations were as follows; 1.) ***Fusion of Architecture and Engineering: Form Follows Function***; 2.) ***Long Span Bridges: Shape and Form Dictate Dynamic Stability***; 3.) ***The Eiffel Tower; Wind Analysis Dictates Shape***; 4.) ***Braced Frames: Bracing as part of Architecture***. These presentations covered the technical and structural elements which are present in some of the world's most dominant, influential, and beautiful structures. In order to fully appreciate the structural and aesthetic qualities of a structure, I believe it is necessary to experience it first hand. Therefore, I organized and coordinated site visits in the metropolitan area to supplement the classroom materials. As a class, we visited structures such as the Hearst Tower, the Brooklyn Bridge, the Flatiron Building, the George Washington Bridge, the Nervis Bus Station, and the WTC Ground Zero site. Through this class, I have learned the importance of connecting textbook knowledge with first-hand experience. This class and my summer research reinforced my awareness of the importance of the visual impact of structures.

For my Senior Design Thesis, I chose to explore the current renovation of the Solomon R. Guggenheim Museum in New York City. This concept of this building was quite innovative for the time in which it was designed and constructed. Ever since the inception of the building, it has suffered extensive surface damage due to the lack of construction joints. Although the building is deemed structurally sound, the displeasing aesthetic quality of cracking and uneven surfaces interferes with the original intention and vision of the architect. In order to gain insight on this problem I studied the details and design plans of the building which were granted for my research and met with the building's representatives and structural engineers to gain insight on the process. My research included studying the cause of the problems that the building currently faces as well as the possible structural solutions, while

maintaining aesthetics. This harmony between aesthetics and structural soundness is vital for the building to maintain its original intention. This Senior Design research has taught me that all of the areas of aesthetics, innovation, efficiency, and economy are equally important in creating a successful structure.

Aesthetics and visual impact of a structure are extremely important in structural design. One structure which I find aesthetically pleasing is The Hearst Tower, located at 300 West 57th Street in New York City. This structure is unique because it utilizes a triangular bracing structural system on the exterior. This system allows for there to be no vertical element, or column, on the perimeter, which is an extremely innovative, structurally unique concept.



(Photograph: Applicant's own, 2006)

The triangulation has inherent strength which carries the gravity load while being effective in resisting the lateral loads of seismic and wind. Another interesting feature of the building is the chamfered corners which help break up wind vortices as well as dampen wind vibrations. The architecture of this building was dictated by its dominant structural components. Another interesting component of this building is the existing six-story masonry historic land-mark below. The contrast of the faceted braced frame tower placed upon the pre-existing Art Deco building at the lower levels is quite intriguing.



(Photograph: Applicant's own- 2006)

In addition to being aesthetically beautiful, the structure is efficient. Since the triangular bracings are so efficient in terms of bearing both gravity and lateral loads, the building uses about 21% less steel tonnage than the conventional building of its size. After a summer of studying the structural concepts and design behind the Hearst Tower, I felt a strong desire to see it first-hand. When taking the trip to the Hearst Tower, I stared up in amazement at the beautiful structure. The visual impact of this aesthetically pleasing structure was stronger than anything I could have ever imagined. My knowledge of the building and its unique design, combined with its strong visual effect created an invigorating experience. This experience personally demonstrated the need for first-hand viewing in order to fully understand and appreciate this structure as a piece of art.

Throughout my learning experience in the area of structural engineering, I have learned the importance of a harmony between aesthetics and structural soundness. The balance of the areas of innovation, aesthetics, efficiency, and economy in structural design is vital for advancements in this field of engineering. My area of interest is dominantly in so-called "artistic structures". In order to fully understand and appreciate the creative structural elements involved and the visual impact of these structures, I believe that a first-hand experience is necessary. I feel that this travel opportunity would truly make my learning experience and interest in structures more complete.

If I were granted this unique opportunity with the travel fellowship, I am confident that my appreciation and understanding of structural engineering and aesthetics would be dramatically heightened. In turn, I would hope to influence the practice of structural engineering in the future. I sincerely thank you for your consideration of me as a candidate.