Civil Engineering: A Surprisingly Noble Career

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Civil engineering is one of the most important professions in today’s society. Everything civil engineers do has a direct impact on the people and environment around them. However, if a civil engineer does not do their job properly, the impacts of their actions could be extremely negative. According to the Minnesota Department of Transportation, “On Aug. 1, 2007, Minnesota suffered a tragedy of historic proportions when the I-35W bridge collapsed” (Minnesota...). In this tragic event, 13 people were killed and 145 injured. Obviously, bridges are necessary structures in today’s society and it is up to civil engineers to design and build structures like this which function properly and do not threaten people’s safety. Due to a grievous mistake made by Sverdrup & Parcel and Associates, Inc. in the construction of the I-35W bridge, innocent lives were lost which shows the importance of a civil engineer’s job. When civil engineers make mistakes, the consequences can be catastrophic and, in the situation of the loss of a human life, irreversible. Thus engineering is a career that does not afford mistakes.

A major concern in everything engineers do is safety. They must be certain that nothing they build or inspect will be a danger to the people using them and must ensure that the structures must be strong enough to endure any forces they might be subjected to such as human use and environmental fatigue. The first fundamental rule in the NSPE’s (National Society of Professional Engineers) Code of Ethics for Engineers is, “Engineers, in the fulfillment of their professional duties, shall: 1. Hold paramount the safety, health and welfare of the public” (National Society of Professional Engineers). Along with their concern for human safety, structural engineers must also take into account the environmental and economic outcomes of their work. While it may not always be possible to produce buildings with absolutely no harm on the environment, there are standards and codes that must be satisfied when designing new structures. Although safety is the main priority for structural engineers, they often have to be able to produce aesthetically pleasing buildings as well. Obviously structural engineers have a lot of pressure on the quality of their work since lives depend on their expertise.

Civil engineers are some of the world’s most creative men and women who use their skills and knowledge to improve the quality of living for all society. Not only do civil engineers fix many problems but they also enhance the quality of living by developing more efficient, safe and comfortable structures and systems. Due to the vast expanse of jobs civil engineers are contracted to do, they are indispensable contributors to society. While civil engineering is not seen as a glamorous or exciting job, much of what civil engineers do help to better society so the job is fulfilling in that sense. In addition, if one is capable of completing the required school and training, civil engineering is one of the most secure and rewarding jobs in today’s society.

“Civil engineering” is an extremely broad term which is inclusive of many areas of work. Richard and Susan McDavid state in their book, Career Opportunities in: Engineering, that “[c]ivil engineering is divided into several subdisciplines in which many Civil Engineers choose to specialize” (2). These subdivisions can be roughly separated into the following groups: Structural Engineer, Geotechnical Engineer, Construction Engineer, Water Resources Engineer, Transportation Engineer, Traffic Engineer, Urban Planner and Environmental Engineer. Depending on which subdivision a civil engineer specializes in, the average work day can widely vary. On the University of Illinois at Urbana-Champaign’s website in the engineering information section it states, “Although each area has its own special body of knowledge and engineering tools, they all rely on the same
fundamental core principles” (*Programs of Study*). Certain civil engineering subdivisions may require almost all work to be done in an office while others must be done entirely in the field or even a mixture of both. Therefore, it is important for one to know his or her work environment preferences when choosing a field in the realm of civil engineering.

Structural engineering is perhaps one of the most widely known subdivisions of civil engineering. According to the Bureau of Labor Statistics, “*Structural engineers* design and assess major projects, such as buildings, bridges, or dams, to ensure their strength and durability” (United States… “Civil Engineering”). Common items that structural engineers design and build include: buildings, bridges, sports stadiums, arenas and towers. Although, oil rigs, spacecraft, satellites and ships could be built by them as well. However, many of the previously stated items require the expertise of many engineers of many different fields of engineering. One of the most recent feats of structural engineering is the Burj Khalifa skyscraper which became the tallest building in the world on January 17, by 2009 standing, “over 828 meters (2,716.5 feet) and more than 160 stories” tall (*Burj Khalifa*).

Geotechnical engineers mostly work with earth materials such as soil and rock, hence the name “geotechnical.” Geo is the Latin root for the English word “earth.” As defined by whatisgeotech.org (a website dedicated to promoting innovation and excellence in the practice of geotechnical engineering),

> Geotechnical engineering is the science that explains mechanics of soil and rock and its applications to the development of human kind. It includes, without being limited to, the analysis, design and construction of foundations, slopes, retaining structures, embankments, roadways, tunnels, levees, wharves, landfills and other systems that are made of or are supported by soil or rock.

A geotechnical engineer’s job mostly consists of soil investigation and fault distribution. The main purpose of these actions is to determine the subsurface conditions of a site on which something is going to be built. Geotechnical engineers predict how stable the ground is in a certain area in order to prevent buildings from being destroyed by earthquakes, landslides and sinkholes. Another major job of a geotechnical engineer is ground improvement. This is a method where the permeability, stiffness and shear strength of soil is modified in order to save costs down the road. This will keep foundations from eroding as quickly which will prevent other complications in the building as well.

Construction engineers are very similar to structural engineers. According to Iowa State University’s College of Engineering’s website, “Construction engineers usually focus on a certain type of construction project” (*Iowa State University College of Engineering*). The website continues on to divide construction engineering into four areas of expertise: Building, Heavy/Highway, Mechanical and Electrical. Each of these areas specialize in different areas of construction, but the necessary degree and education is same for all. One of the major differences between construction engineers and structural engineers is construction engineers must complete classes concerning construction site management. This is to help save time and money on the construction process. Usually there is at least one structural and construction engineer working together on the same project. Structural engineers are more focused on the designing of structures whereas construction engineers specialize more in the area of managing and consulting.

A water resources engineer, also called a hydrologist, specializes in knowledge concerning the movement and distribution of water. According to the Occupational Outlook Handbook, “Hydrologists study how water moves across and through the Earth’s crust. They can use their expertise to solve problems in the areas of water quality or availability” (United States… “Hydrologists”). Most hydrologist positions are government jobs such as working for a city or town regarding waste control and clean water distribution. Other jobs a hydrologist might do may be...
environmentally related such as flood and landslide risk and warning. Often times, hydrologist will work with structural engineers during the construction of bridges by calculation the force exerted on the bridge by the moving water. It is very rare that hydrologist ever work on a project alone, usually their work is done to provide information for the construction of a new building or the safety of an existing structure such as a bridge or canal.

Transportation engineering is exactly what it sounds like. It is the engineering of transportation systems and facilities to produce maximum cost effectiveness, efficiency, safety and comfort for the people using the systems. According to CNN, a transportation Engineer, “[A]nalyzes, plans, designs, draws, checks calculations and oversees highway, rail and related transportation civil construction projects” (CNN Money). Most of a transportation engineer’s job consists of predictions and planning. They must be able to estimate how many trips will be made to specific areas in order to provide adequate transportation systems to and from each area. Efficiency is a major concern in a transportation engineer’s job. They must be able to determine the fastest way to transport passengers and goods from one place to another by more than one method. Also they must design facilities such as airports and train stations which can efficiently, effectively and safely get passengers to their destination. Another critical part of transportation engineering involves the development and implementation of systems to ensure smooth travel such as road signs and light signals. Transportation engineers are extremely important in today’s society since without them our transportation systems would be chaotic and uncontrolled. Also as the population grows there will be a greater need for transportation of food and goods so transportation engineers will always be needed.

Traffic Engineering is very similar to both urban planning and transportation engineering. However, traffic engineers have a more specific focus than urban planners or transportation engineers. According to the Institute of Transportation Engineers, traffic engineers “facilitate the application of technology and scientific principles to research, planning, functional design, implementation, operation, policy development and management for any mode of ground transportation” (Institute of Transportation Engineering). Traffic engineers mainly specialize in the area of traffic flow, traffic signs, road markings and traffic lights. Unlike transportation engineers, traffic engineers are not involved in the building or design of any transportation related structures. They are concerned principally with the flow of traffic on existing roadways or designing systems for new roadways. Traffic engineers will also look at areas of high crash rates and develop explanations and solutions for the problems causing the crashes.

The job of an urban planner, also known as a city planner, is to optimize the use, effectiveness and functionality of cities, towns and villages. According to the Bureau of Labor Statistics’ Occupational Outlook Handbook, “Urban and regional planners develop plans and programs for the use of land. Their plans help create communities, accommodate population growth, and revitalize physical facilities in towns, cities, counties, and metropolitan areas” (United States… “Urban and Regional Planners”). Things that an urban planner must take into consideration when planning an area are things such as fire and police stations, hospitals and schools. For example, it would be more effective to have a fire station in the middle of a village rather than on the outskirts in order to minimize distance from the station to any point in the village. Other issues such as crime, land value, air pollution and traffic congestion must also be taken into account when designing and planning an urban area. For instance, if one area of a town has a higher crime rate than any other area, it might be most practical to put the police station near that area.

Environmental engineering is one of the broadest subdivisions in civil engineering and is a combination of science, engineering principles. The Bureau of Labor Statistics states, “Environmental engineers use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. They are involved in efforts to improve recycling, waste disposal, public health, and water and air pollution control” (United States… “Environmental
Engineers”). In order to enhance the quality of human life, environmental engineers pursue to provide society with a healthy environment to live in. They do this by providing healthy water and air for human use to the best of their ability. Environmental engineers are concerned with how technological advances are effecting the environment and if the effects are harmful they attempt to provide a solution. They also strive to provide optimum sanitation to urban environments. Along with these tasks, environmental engineers regulate industrial hygiene, environmental sustainability and public health issues. Environmental engineering is perhaps one of the most important careers concerning society’s health and well-being.

Since there are numerous jobs a civil engineer could do due to the many subdivisions, the salary of civil engineers varies greatly. According to the Bureau of Labor Statistics, “The median annual wage for civil engineers was $79,340 in May 2012” (“Occupational…”). However in a personal interview, Professor Scott Banjavic, an engineering professor at The College of DuPage, stated that the starting salary for a civil engineer is “anywhere between $45,000 and $65,000.” The Bureau of Labor Statistics also states that the top paid ten percent of civil engineers earned an average annual wage of $126,190. This is because the salary of civil engineers tend to increase with their years of experience. The area in which a civil engineer works has a major influence on their salary depending on the cost of living, taxes and many other factors. Banjavic confirms this by saying that although the average starting salary for civil engineers is around $45,000 to $65,000, for civil engineers, “in Chicago it’s closer to $60,000.” Obviously, this is on the higher end of the starting average starting salary scale. As job experience increases over one’s years of work, his or her pay tends to increase as well. The same trend can be seen as education increases. In the Field of engineering, “if you have your master’s degree you tend to earn about $10,000 more” than the average starting salary (Banjavic).

In order to become a civil engineer there are specific training and educational requirements that are usually expected to be met and “at the very least you have to have a bachelor’s degree” (Banjavic). Banjavic stated that 4 years of schooling is the usual amount of time it takes to obtain a bachelor’s degree in civil engineering. This degree must be obtained from an ABET (Accreditation Board for Engineering and Technology) accredited institution. Although one can obtain their civil engineering degree from any ABET accredited institution, some schools are superior and expedite the job search. Currently, the civil engineering program at the University of Illinois at Urbana-Champaign is rated the best civil engineering program in the nation. This is due to their ability to give students the most and up-to-date education regarding civil engineering. Their curriculum is constantly changing in order to stay current and fit the civil engineering needs of society.

Along with their Bachelor’s degree, “Most civil engineers go on to study and qualify for a professional engineering (PE) license. It is required before one can work on projects affecting property, health, or life” (“Civil Engineers” 38). Since “most companies will want you to become a professional engineer,” right out of school a test must be taken called the fundamentals of engineering exam (Banjavic). Once this test has been taken, four years of field work is required before one can take the final exam called The Professional Engineering exam. However, if one obtains their Master’s degree that can count for one of the four required years. There are five different civil engineering PE exams. Each exam focuses on a different area of civil engineering due to the many subdivisions. Engineers usually start studying for this test at the beginning of their junior year due to the extreme difficulty of the test. According to NCEES (National Council of Examiners for Engineering) over 29% of test takers need to take the test twice in order to pass.

Along with the education requirements of civil engineering, most companies expect potential employees to have obtained certain on-the-job training and experience. The most common way for one to acquire this training and experience is through internships. Without internships it is very hard to procure a satisfactory position in the field of engineering. Therefore, it is extremely beneficial to complete at least one internship between ones freshmen and senior year of undergraduate studies. In
a personal interview, Professor Banjavic stated that “because of my internships I not only got valuable training and experience, but I also figured out what I didn’t want to do in engineering.” It is common for civil engineering interns to be a junior engineer at an engineering firm. As described by Chevron, one of the most prominent energy corporations, engineering internships, “Develop your skills under the supervision and guidance of experienced professionals” (Chevron). Junior engineers will usually follow around an experienced engineer and run errands and file paperwork for them while at the same time getting hands-on training. Therefore, it is not only beneficial for one studying civil engineering to complete internships for the sake of the job outlook but also for the sake of one’s personal interests.

While there are many associations for the numerous subdivisions of civil engineering, there is one widely recognized association which is inclusive of all civil engineering subdivisions. This association is the American Society of Civil Engineers (ASCE) with over 145,156 members is the largest and most respected society regarding civil engineering. With multiple conferences held each month around the nation and some even around the world, it is not hard to find a conference that fits one’s schedule. Along with conferences, the ASCE puts out a magazine called Civil Engineering which is digitally published monthly. Membership to the ASCE is free for students and they offer many benefits for their young members along with information about student organizations in one’s area. However, if one is not a student, there are membership dues. The cost of membership ranges from $33 to $260 depending on the number of years after one has earned their baccalaureate degree. Even though it may seem a bit expensive, the benefits one receives from being a member of the ASCE are worth much more than the dues required.

The ASCE’s website offers its members tools which help in the understanding of the education requirements in the field of civil engineering. It provides information on the codes and standards used in the field and can connect the reader to helpful books and journals. Another aspect of the ASCE is it offers information and advice on getting certified and also continuing education. ASCE also provides information on leadership and management. This area of information concerns awards in many different aspects of the field given to civil engineers who demonstrate an impressive level of skill, leadership and many more valuable traits.

It is also very important to stay well-informed on the issues of one’s field. Aware of this, the ASCE provides information about pertinent and current issues in the field of civil engineering. Also since new technologies and methods are evolving at such a fast rate, it is necessary to stay informed as to not waste time and money using outdated tools and techniques. If there is a controversy or major issue in the civil engineering profession ASCE’s gives essential information and details concerning the problem. Sustainability is currently a main interest in engineering. ASCE’s website ”offers a host of resources to help civil engineers plan and execute with sustainability in mind, and supports other professional groups pursuing the same objectives” (ASCE). The website also offers a journal in which many intelligent and experienced engineers share ideas and methods for more efficient methods and safer materials.

In the field of civil engineering, environmental sustainability is a major controversy. With the population of earth growing at an increasingly fast pace, it is important to recognize that our resources are limited and valuable. On their website, ASCE defines sustainability as “[a] set of environmental, economic and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or availability of natural, economic and social resources” (American Society of Civil Engineers). In order to prolong the health and existence of our population, there are certain requirements that must be met by civil engineers when building new structures or inspecting old ones. One major advancement being made in the field of structural engineering pertains to lighting. Jeff Siegel states in his book, Investing in Renewable Energy, “Commercial and residential buildings in the United States used 40 quadrillion Btus (quads) of energy in 2005, at a cost of $300 Billion”
However Siegel also states, “196 LEDs draw only W, compared to the 150 W that an incandescent light draws” (124). Therefore, with the implementation of LED requirements in new structures, millions of dollars will be saved in energy each year. Along with conserving energy, civil engineers must also be aware of the environment and the effects their job has on it. With the building of new structures, often times the construction will destroy plants and push out wildlife. Therefore, civil engineers have to meet certain standards when designing and building structures. According to ASCE, these “[s]tandards provide technical guidelines for promoting safety, reliability, productivity and efficiency across all areas of civil engineering. These voluntary standards are written by experts with knowledge and expertise in a particular field” (ASCE). A relatively new concept is the idea of green roofs. Not only do green roofs benefit the environment around them but they also allow for wildlife such as birds and insects to build homes in an otherwise inhabitable environment.

As long as humans have existed there has always been a demand for shelter and safety. When civilizations arose, shelters were not the only structures needed. As stated in Ancient Technology: Ancient Construction, “In addition to homes, ancient people built monuments, palaces, roads, dams, bridges, canals, tunnels, harbors, light houses, sewage systems, and many other structures” (Woods 7). Therefore, civil engineers were needed to design and build these buildings, aqueducts and other systems. Ancient Rome is renowned for their complex and efficient aqueducts. Some were over 60 miles in length and retained a steady downward sloping grade to carry water from mountain springs to the city center (Aicher). Even today, the Roman aqueduct system is regarded as one of the most incredible feats of civil engineering. The term “civil engineering” was coined in the 18th century to distinguish between civil and military engineering. In the ancient times, civil engineers were not only seen as builders and designers but also as inventors. Although civil engineers still invent new buildings and methods to this day, nowadays civil engineers mainly attempt to perfect or enhance existing ideas.

Benjamin Wright is one of the most important civil engineers in America’s history of civil engineering. According to the National Park Service, Wright was the chief engineer on the Erie Canal project in 1817 and led numerous other projects as well (Engineer Benjamin Wright). The Erie Canal project entailed leading and guiding thousands of unskilled workers who built the canal with wheelbarrows, shovels, horses and mules. After completing the Erie Canal, Wright was appointed chief engineer for the Chesapeake and Ohio Canal due to his unprecedented reputation. Along with Wright’s engineering work, he was also appointed a New York county judge in 1794. According to Connecticut History.org, “in 1969 the American Society of Civil Engineers (ASCE) declared him ‘‘the Father of American Civil Engineering’’ (Connecticut History.org).

Civil engineers will always be needed. As society grows, the demand for structures will grow as well. Along with the building of new structures, the inspection of existing structures will always be needed. In his article “Mega-Engineering” in Popular Mechanics, Davin Coburn states, “The economy may be struggling, but there is still plenty of work to be done in America. Aging Bridges need to be replaced, ships need building, energy needs to be produced” (61). Also, in the past fifty years the world has seen incredible advances in the area of science and technology. With these progressions, new systems and structures are needed to be designed and built. An article published by Tech News Daily, a popular and respected online scientific news source, states, “Thanks to new technologies and new testing methods, some of today's largest buildings can stay safe in a quake without compromising their size or aesthetic design. In fact, to attain their great height, many of the world's largest buildings utilize architectural elements that also protect them in case of disaster” (“The World’s 7…”). These earthquake resistant buildings could save thousands of lives, which shows the value and usefulness of civil engineering.

While civil engineering may not be a career that one dreams of entering as a child, it truly is a noble career. Thousands of people’s lives depend on civil engineers doing their job properly. As seen in the example of the bridge collapsing in Minnesota, the consequences of even the smallest mistake
in this career can be devastating. Civil engineers work each and every day to enhance the quality of life for society and ensure their safety. Therefore, it is clear that civil engineering is one of the most important careers existing today.

Works Cited

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