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Civil Engineering's Various Feats in Public Works

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Introduction:

Have you ever pondered how tall skyscrapers stay standing, or how marathon runners race for kilometers without bridges collapsing? When it comes to road design or steel design it is the Civil engineers and they are the masterminds behind it all. These wizards of the physical world design and build the very foundations of our lives, from bustling cities to serene landscapes, ensuring everything runs smoothly, from the water we drink to the roads we race down. So, join the ranks of these unsung heroes and become the designer of tomorrow's wonders, since with civil engineering, the impossible becomes your blueprint!

Background or Origin of CE:

Civil engineering's inception as a distinct discipline traces back to France in 1716 with the establishment of the Bridge and Highway Corps, evolving into the École Nationale des Ponts et Chaussées in 1747. This institution's teachers produced seminal works on mechanics, machines, and hydraulics, influencing British engineers who learned French to access these texts. In 1771, John Smeaton, who began as an instrument maker, founded the Society of Civil Engineers (now the Smeatonian Society) in Britain. This society aimed to bring together experienced engineers, entrepreneurs, and lawyers to support large public works projects such as canals and railways. Notable civil engineers of the time, including James Brindley, John Rennie, and Thomas Telford, started as talented craftsmen like millwrights, stonemasons, and instrument makers. As design and calculation techniques replaced empirical formulas, nonmilitary engineers gained prominence, and the Society of Civil Engineers played a pivotal role in promoting and securing parliamentary support for major infrastructure projects.

During the Spanish era in the Philippines, civil engineering was not based on academic titles, as there were no civil engineering schools in the country at the time. Academic degrees in architecture and engineering were held exclusively by Spaniards. The walled city of Intramuros was established by the Spaniards as a model community, and Friar Architects/Engineers, often with academic backgrounds, played a crucial role in constructing government buildings, bridges, and residential structures, incorporating European engineering and architectural standards. Throughout the 18th and 19th centuries, Filipino engineers were tasked with maintaining, repairing, and remodeling infrastructure in towns, including churches, convents, and government buildings. The "Maestro de Obras," or master builders, were sought after by the elite group known as the Ilustrados to construct structures in villas and mansions. This historical period reflected a reliance on practical expertise rather than formal academic training in civil engineering in the Philippine

The San Francisco Bridge:

The San Francisco Bridge, also known as the Golden Bridge, was constructed to connect San Francisco with Marin Country to the north. Construction was completed in 1937, the bridge was a symbol of power and progress of the United States due to its massive size and length.

The construction of this bridge was facilitated by chief engineer Joseph B. Strauss,

The person behind the success of constructing the Golden Bridge. Engineer Strauss faced a lot of challenges in constructing the bridge such as the violent tides, frequent storms, fog, etc. which made construction a lot harder. One process of constructing the bridge that exhibited brilliant civil engineering was setting up timed bombs within the seabed to remove it instead of planting the timed bombs on the seabed's surface. After clearing the area for construction, underwater assemblies were built to create the body of the seabed foundation. Cement is then ready to be poured inside the foundation frame but there was another problem. Ordinary cement would lose its compactness when it came in contact with water so, Engineer Strauss used a PPC cement mixture which is water resistant. After pouring the concrete, the foundation was complete.

The next step was to build the two iconic towers of the San Francisco bridge which held the cables. A climbing Derrick was used to continuously build the two towers and a saddle was mounted in the two towers, this was used for the large cable to pass through the towers. The large cable consisted of 27,000 steel cables, enough to support the loads in the bridge. Eventually the cables were fully attached and the road deck was installed. The San Francisco bridge consists of a three lane road, a sidewalk for pedestrians, and a bike lane, open to all for transportation.

Cebu-Cordova Link Expressway

The Channel Tunnel, also known as the Chunnel, is a 31.4-mile (50.5 km) undersea rail tunnel that connects Folkestone, Kent, in England, with Coquelles, Pas-de-Calais, in France. It is the only fixed link between the two countries and the longest undersea tunnel in the world. The tunnel was constructed between 1988 and 1994 and opened on May 6, 1994. It is a crucial component of the European transportation system and used by both passenger and freight trains.

The construction of the Channel Tunnel was a major engineering challenge. The tunnel had to be built under the English Channel, which is one of the busiest shipping lanes in the world. The tunnel also had to be deep enough to avoid interfering with shipping traffic and strong enough to withstand the high-water pressure and the movement of tectonic plates. The Channel Tunnel was constructed using several innovative engineering techniques. These included:

- Tunnel boring machines (TBMs): TBMs were used to excavate the majority of the tunnel. TBMs are large, cylindrical machines that are equipped with cutting heads and conveyor belts. The cutting heads rotate and break up the rock, while the conveyor belts remove the debris.
- Segmental construction: The tunnel is made up of prefabricated concrete segments. The segments were manufactured in factories and then transported to the tunnel site. The segments were then assembled and bolted together to form the tunnel lining.
- Grouting: Grout is a liquid mixture of cement and water that is injected into the ground to fill cracks and voids. Grouting was used to strengthen the ground around the tunnel and to prevent water from leaking into the tunnel.

The Channel Tunnel has had a significant impact on society. It has made it easier and faster to travel between England and France, reducing travel time from hours to just 35 minutes. This has not only improved convenience for passengers but has also facilitated the movement of goods and services between the two countries. The Channel Tunnel has increased trade between England and France by 20% since its opening, according to a University of Kent study. Additionally, the tunnel has boosted tourism, with an estimated 10 million tourists using the tunnel each year to visit popular destinations on both sides of the English Channel. It has made it easier and faster to travel between England and France. It has also boosted trade and tourism between the two countries. The Channel Tunnel is a testament to the ingenuity of civil engineers and a reminder of the power of human imagination. In addition to its impact on travel and trade, the Channel Tunnel has brought significant economic and environmental benefits. The construction of the tunnel created thousands of jobs, both during the construction phase and in ongoing operations and maintenance. This has had a positive effect on the local economies in both England and France. Furthermore, the tunnel has helped to reduce carbon emissions by providing a more sustainable mode of transportation. Traveling by train produces significantly less carbon dioxide compared to traveling by car or plane. By encouraging more people to choose train travel over other modes of transport, the Channel Tunnel has contributed to efforts to combat climate change and reduce air pollution.

Conclusion:

In conclusion, civil engineering stands as the backbone of modern society, shaping the world we live in and overcoming seemingly insurmountable challenges. The fascinating tales of structures like the San Francisco Bridge and the Channel Tunnel underscore the brilliance and innovation of civil engineers who transform ambitious visions into tangible, functional realities.

The story of the San Francisco Bridge reveals the meticulous planning and problem-solving skills of engineers, exemplified by Chief Engineer Joseph B. Strauss. Overcoming natural obstacles such as violent tides and storms, engineers employed ingenious techniques, like strategically timed underwater explosions and the use of water-resistant PPC cement, to build a foundation capable of supporting this colossal structure. The construction of the iconic towers and the intricate cable system further demonstrates the precision and expertise required in civil engineering.

Similarly, the Channel Tunnel, a marvel beneath the English Channel, showcases the ingenuity and resilience of civil engineers. Facing challenges unique to undersea construction, engineers employed tunnel boring machines, segmental construction, and grouting to ensure the tunnel's stability and functionality. The impact of the Channel Tunnel extends beyond its engineering feats, significantly improving travel, trade, and tourism between England and France. Moreover, its contribution to job creation, economic growth, and environmental sustainability emphasizes the broader positive effects of civil engineering on society.

These two engineering marvels stand as testaments to the capabilities of civil engineers in shaping the world's infrastructure. As we marvel at the Golden Bridge's majestic presence and the Channel Tunnel's transformative impact, it becomes evident that civil engineering is not just about structures; it is about connecting communities, fostering progress, and leaving an indelible mark on the landscape of human achievement. Aspiring civil engineers are invited to join this noble profession, where the impossible becomes the blueprint for a better, more connected world.