

Student's Name

Professor's Name

Subject

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The Tower of Pisa is a particularly complex symbol of Italy

Thesis

The Tower of Pisa known globally due to its mysterious lean which is nearly four degrees, brought about by an unstable foundation. Focusing on the details regarding the architect, construction history, earthquake survival, entry into Guinness world records and technical information of the Tower will help in understanding the Tower.

Caprili, Silvia, Federico Mangini, Sandro Paci, Walter Salvatore, Marco G. Bevilacqua, Ewa Karwacka, Nunziante Squeglia, Riccardo Barsotti, Stefano Bennati, Giuseppe Scarpelli, and Paolo Iannelli. "A Knowledge-Based Approach for the Structural Assessment of Cultural Heritage, a Case Study: La Sapienza Palace in Pisa." *Bulletin of Earthquake Engineering: Official Publication of the European Association for Earthquake Engineering*. 15.11 (2017): 4851-4886. Print.

Caprili et al. are authors with diverse backgrounds in history and assessment of the structure. In the article, Caprili et al. argue that the tower is believed to have started leaning during the construction period in the 12th century, because of soft ground that could barely support the weight of the structure. This article is important in researching the leaning of the Tower. The leaning worsened at its completion in the 14th century and is said to have

reached about 5.4 degrees by 1990. Since 1280, four earthquakes of high magnitudes have hit the region but the Leaning Tower that was considered vulnerable survived their effect. The researchers discovered that the tower could withstand the earthquakes owing to the interaction of dynamic soil structure. They concluded that vibrational features of the building are influenced by the height, stiffness of the structure alongside the soft soil in the foundation. Because of this, the tower is not able to resonate with the ground motion of the earthquake. It is ironical that soft soil, instead of contributing much towards the vulnerability of the building to earthquake effects, helped its survival from the very effects. Given the details provided in this article, they

Simón, Armando. "Will Evolutionary Psychology Become Extinct? Evolutionary Psychology as the Leaning Tower of Pisa." *Journal of Human Behavior in the Social Environment*. 28.7 (2018): 928-935. Print.

Simon in the articles brings the psychological aspect analysis of the Tower, which is essential in understanding the historical background of the Tower. Simon argues that the building appears curved because the engineers built the upper floors in such a way that one side was taller to compensate for the tilt. The defeat of the Pisans by the Girona in 1284 led to another halt of construction. Historically, Simon argues that the completion of the seventh floor and the bell chamber (consisting of seven bells, each projecting a different musical note) occurred in 1319 and 1372 respectively. The holistic construction of the tower from the foundation to completion was an effort contribution to many engineers. The construction of the Leaning Tower of Pisa took place in three phases over 199 years. The construction progress halted for almost a century from its beginning due to several factors, major being a weak foundation set in the unstable subsoil, which could barely support beyond two floors up. The aspects are essential in carrying out this research.

Clemente, Paolo, Fernando Saitta, Giacomo Buffarini, and Laura Platania. "Stability and Seismic Analyses of Leaning Towers: the Case of the Minaret in Jam." *The Structural Design of Tall and Special Buildings*. 24.1 (2015): 40-58. Print.

Clemente et al. provide the structural and architectural aspects of the building that enables it to sustain earthquakes. Besides, the authors bring in the discussion of their building that was constructed in resemblance to the Tower. According to Clemente et al. in recent years, the leaning tower of Wanaka, a building in New Zealand, also deliberately structured to tilt was discovered to be the most slanted man-made building in the globe. It is 53.98 degrees tilted towards the ground. Some cast material was discovered underneath the Tower bearing Pisano's name in 1820. However, it may have been related to the destruction of the cathedral's façade in 1595, which had a bronze door. A latter study in early 2001 indicated Diotalvi as the original architect of the tower owing to the affinity of time of its construction with other works of his, which were noted to be in Nicola bell tower and the baptistery all happening in the city of Pisa. The comparison of the Tower and other buildings is vital in expounding the architectural aspects that are used in the construction of the tilted building.

Lazzarini, Marco, Simona Raneri, Stefano Pagnotta, Stefano Columbu, and Gianni Gallelo.

"Archaeometric Study of Mortars from Pisa's Cathedral Square (Italy)."

*Measurement*. 126 (2018): 322-331. Print.

The tower of Pisa is the third oldest of all the structures existing in the cathedral square of the city, after the Pisa Cathedral and the Baptistry of Pisa. This paper gives a summary of details regarding the architect, construction history, earthquake survival, entry into Guinness world records and technical information of the Tower. It is believed that Galileo Galilei, who was a Pisan resident between 1589 and 1592, dropped some cannonballs

having different masses from the leaning tower of Pisa to demonstrating the independence of the speed of descent and mass. Lazzarini et al. (2018) argue that the tower is suspected to have been used by the Germans as an observation tower during World War II. The beauty of the cathedral alongside its campanile is said to have impressed an army sergeant from the U.S who had been sent to spy on the German rifles in the tower thus restraining an artillery strike order to destroy it.

Squeglia, Nunziante, and Giuseppe Bentivoglio. "Role of Monitoring in Historical Building Restoration: the Case of Leaning Tower of Pisa." *International Journal of Architectural Heritage*. 9.1 (2015): 38-47. Print.

Squeglia and Giuseppe bring the aspect of corrective measures that were undertaken to reinforce and stabilize the tower after it started leaning to the foundation in weak ground. After about a hundred years of effort to corrective reinforcement and stabilization, most of which are visible damages such as corrosion and blackening, the tower has been gradually restored and was declared to be stable for another 250 years at the least. The leaning tower of Pisa was the first building to enter the Guinness book of the world's records as the only existing tiled story building. However, some more other buildings have been established to be leaning even at higher angles towards the ground relative to the Tower of Pisa. The leaning tower of Suurhusen and the bell tower in the Bad. The fifth bell in the bell chamber, which indeed is older than the chamber itself has peculiar significance. According to Squeglia et al., it was only rung during Easter day hence its name Pasquareccia. It was brought from the Vergata tower where it was sounded to announce the execution of lawbreakers and traitors. It was called La Giustizia, meaning "justice". This article is beneficial because it shows the concern people had on the leaning of the building and will be instrumental in the research.



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