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Case study on the construction of Burj khalifa

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ABSTRACT

The Burj Dubai Project is the tallest structure ever built by man. The tower is more than 800 meters tall and more than 160 floors. The early integration of aerodynamic shaping and wind engineering considerations played a major role in the architectural massing and design of this residential tower, where mitigating and taming the dynamic wind effects was one of the most important design criteria. While the focus of this paper will be on the construction planning of the tower, this paper will briefly present an overview of the structural system of the tower's design and construction, which are integrated from the early design concept.

Keywords:*Burj Dubai, Planning, Engineering, Construction, Material*

I.INTRODUCTION

The Burj Dubai Project is a multi-use development tower with a total floor area of 460,000 square meters that includes residential, hotel, commercial, office, entertainment, shopping, leisure, and parking facilities. The Burj Dubai project is designed to be the centerpiece of the large scale Burj Dubai Development that rises into the sky to an unprecedent height that exceeds 700 meters and that consists of more than 160 floors.

The Client of Burj Dubai Tower, Emaar Properties, is a major developer of lifestyle real estate in the Middle East. Turner International has been designated by the owner as the Construction Manager, and Samsung Joint Venture (consisting of Samsung, Korea base contractor; Besix, Belgium base contractor; and Arabtec, Dubai base contractor) as the General Contractor.

The design of Burj Dubai Tower is derived from geometries of the desert flower, which is indigenous to the region, and the patterning systems embodied in Islamic architecture.

The tower massing is organized around a central core with three wings. Each wing consists of four bays. At every seventh floor, one outer bay peels away as the structure spirals into the sky. Unlike many super-highrise buildings with deep floor plates, the Y-shape floor plans of Burj Dubai maximize views provide tenants with plenty of natural light. The modular Y-shaped building, with a setback at every seventh floor, was part of the original design concept that allowed Skidmore, Owings and Merrill to win the invited design competition.

The tower superstructure of Burj Dubai is designed as an all reinforced concrete building with high performance concrete from the foundation level to level 156, and is topped with a structural steel braced frame from level 156 to the pinnacle.

The tower massing is also driven by wind engineering requirements to reduce dynamic wind excitation. As the tower spirals into the sky, the building's width and shape diminish, thus reducing wind dynamic effects, movement, and acceleration. Integrating wind engineering principals and requirements into the architectural design of the tower results in a stable dynamic response,, taming the powerful wind forces.

II.LITERARY REVIEW

I. Harshal P. Gandhi, Rajyaguru Sawan

They studies the foundations and site conditions of the structure. In their study it was found that the tower foundations consist of a pile-supported raft. The solid reinforced concrete raft is 3.7m thick and was poured utilizing C-50 self-consolidating concrete. The raft was constructed in 4 separate pours and each raft pour occurred over at least a 24-hour period. 194 bored cast-in-place piles support the tower raft. The piles are 1.5 m in diameter and approx. 43 meter long with design capacity of 3000 tones each. The ground water in which the Burj Khalifa sub structure is constructed contains concentrations of unto 4.5 per-cent, and sulfates of unto 0.6 percent. Hence they are the primary consideration in designing the piles and raft foundations durability. Due to present aggressive conditions caused by the extremely corrosive ground water condition, they added corrosion inhibitors to the concrete mix.

II. Sara Masjedi, David Larson

Their study of the structural engineering applications in the Burj Khalifa concluded that the tower requires structural engineering due to the fact that measurements and tests had to be conducted to determine that the 828 meter building would not collapse upon itself during its construction. Without structural engineers, the Burj Khalifa would never have been constructed because no other people would be able to calculate data that would make sure that several different factors such as wind, foundation systems, concrete, and viable geometric design among other things would be satisfied. Although many people would assume that architects would be able to perform such tasks and that structural engineers would not be necessary in this project, architects only design a building whereas structural engineers make sure that the building can support itself and not crumble and fail.

III. James Aldred

In his research he studies implications for high performance concrete as the future of construction. He concluded that High-performance concrete offers immense benefits to developers, consultants and contractors working on the hundreds of super-tall structures under construction and planned in the Middle East and elsewhere in the world. The material's high strength and modulus mean that super-tall buildings can have more slender vertical elements. Also, as has been proved on the Burj Khalifa project in Dubai, single-stage pumping to over 600 m is now possible and this, together with high early strengths, allows rapid cycle times to meet today's demanding construction schedules. However, appropriate care and attention to mix design, placing, protection and curing is vital to minimise potential problems with pump blockage, segregation, autogenous shrinkage and cracking. Burj Khalifa shattered all previous world construction records by a considerable margin and required an enormous effort by all parties involved to overcome its many construction challenges – not least with regard to using high-performance concrete (Figure 8). In the quest to build the world's next tallest structure, the lessons learned at Burj Khalifa must not be overlooked.

III.CONCLUSION

At the turn of the century, nobody then could have dreamed of creating a building this tall using concrete. The Burj Dubai project demonstrates that tall building system development is always directly related to the latest developments in material technologies, structural engineering theories, wind engineering, seismic engineering, computer technologies, and construction methods. The Burj Dubai project capitalizes on advancements in these technologies, advancing the development of supertall buildings and the art of structural engineering.

As of today, the Burj Dubai is the tallest man made structure in the world in all categories, and it has become a catalyst for further development in highrise construction in the Middle East and through throughout the world.

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REFERENCES

[1.] ACI committee 305 (1999) ACI 305R-99: Hot Weather Concreting. American Concrete Institute, Farmington Hills, MI, USA.

[2.] Aldred JM (2007) Pumping concrete on the Burj Dubai. Terence C. Holland Symposium on Advances in Concrete Technology - 9th CANMET/ ACI International Conference on Fly Ash, Silica Fume, Slag and Natural Pozzolans in Concrete, Warsaw Poland (Hoff GC (ed.)). American Concrete Institute, Farmington Hills, MI, USA, pp. 497–514.

[3.] Aldred JM and Lim SN (2004) Factors affecting the autogenous shrinkage of ground granulated blast-furnace slag concrete. In 8th CANMET/ ACI International Conference on Fly Ash, Silica

Fume, Slag and Natural Pozzolans in Concrete (Malhotra VM (ed.)). American Concrete Institute, Farmington Hills, MI, USA, SP 221, pp. 783–796.

[4.] CTBUH (Council on Tall Buildings and Urban Habitat) (2010) http://buildingdb.ctbuh.org/index.php (accessed 15/01/2010)

[5.] Coussot P and Roussel N (2006) Quantification de la thixotropie des matériaux cimentaires et de ses effets. Revue Européenne de Génie Civil 10(1): 45–63 (in French).

[6.] Hover KC (2006) Evaporation of water from concrete surfaces. ACI Materials Journal 103(5): 384–389.

[7.] NRMCA (National Ready Mixed Concrete Association) (1960) Plastic Cracking of Concrete. NRMCA, Silver Spring, MD, USA.

[8.] Roussel N and Cussigh F (2008) Distinct-layer casting of SCC: The mechanical consequences of thixotropy. Cement and Concrete Research 38(5): 624–632.

[9.] VDT (Virginia Department of Transportation) (2002) Road and Bridge Specification. VDT, Richmond, VA, USA, Section 404.03, p. 441.