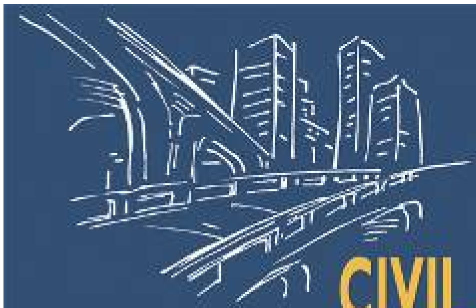

DEPARTMENT OF CIVIL ENGINEERING AND GEOLOGICAL SCIENCES
UNIVERSITY OF NOTRE DAME

Spring 2010 Seminar Series

CHALLENGES AND INNOVATION IN CIVIL AND ENVIRONMENTAL ENGINEERING

Philosophy of Structural Engineering for the Burj Khalifa (Dubai) Tower

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Director of Engineered Buildings for the Portland Cement Association

Wednesday, April 7, 2010, 4:30pm
129 DeBartolo Hall

The recently opened Burj Khalifa Tower, formally known as the Burj Dubai, is the world's tallest manmade structure. The multi-use skyscraper, located in Dubai, UAE, an equivalent UBC 97 seismic zone 2A, soars to over a half mile high (828 meters, 2717 feet). The 280,000 m^2 (3 million square feet) reinforced concrete multi-use Tower is utilized for Retail, a Giorgio Armani Hotel, Residential and Office. The goal of the Burj Khalifa Tower is not simply to be the world's highest building; it's to embody the world's highest aspirations.

Designers purposely shaped the structural concrete Burj Dubai – "Y" shape in plan – to reduce the wind forces on the tower, as well as to keep the structure simple and foster constructability. The structural system can be described a "buttressed" core. Each wing, with its own high performance concrete core and perimeter columns, buttresses the others via a six-sided central core, or hexagonal hub. The result is a tower that is extremely stiff laterally and torsionally. Skidmore, Owings & Merrill (SOM), the architects and engineers for the project, applied a rigorous geometry to the tower that aligned all the common central core and column elements.

Each tier of the building steps back in a spiral stepping pattern up the building. The setbacks are organized with the Tower's grid, such that the building stepping is accomplished by aligning columns above with walls below to provide a smooth load path. This allows the construction to proceed without the normal difficulties associated with column transfers.

The Tower's width changes at each setback. The advantage of the stepping and shaping is to "confuse the wind". The wind vortices never get organized because at each new tier the wind encounters a different building shape. This enhanced wind behavior coupled with the mass and damping provided by the high performance concrete, work together to minimize the forces and motions of the structure. High performance concrete is becoming the material of choice for the next generation ultra-tall high-rise buildings.

The presentation will discuss the philosophy behind the structural design and sustainable design of the world's tallest structure.

Lawrence C. Novak has more than 25 years of experience as a structural engineer on high-rise, mid-rise and special use structures throughout the world, including seismic regions. Prior to joining the PCA, he was an Associate Partner with Skidmore, Owings & Merrill where he recently served as the lead structural engineer for the Burj Khalifa, Dubai, the world's tallest building.

A reception and an opportunity to meet the speaker will take place at 4:00pm in the CE/GEOS office conference room, Fitzpatrick 156, before the seminar