Wind Related Issues & Use of Supplementary Damping Systems in Design of Tall Buildings

CIVIL AND STRUCTURAL ENGINEERING TECHNICAL DIVISION

reported by
Ir. Low Kai Wah,
Committee Member,
CSETD

The Civil and Structural Engineering Technical Division (CSETD) organised a short talk on "Wind Related Issues & Use Of Supplementary Damping Systems in the Design of Tall Buildings" on 27 July 2016 at Wisma IEM. The invited speaker was Mr. Sudeesh Kala, a registered Professional Engineer (Ontario) with vast experience in wind analysis and exposure to various international projects.

The seminar was chaired by Ir. Dr Ng, Chairman of CSETD. The 78 participants came from various industry backgrounds, including engineers from consultancy services, contracting firms, government agencies and local authorities as well as faculty members from local institutions of higher learning.

Mr. Sudeesh Kala started the talk by highlighting the types of risks associated with wind force such as structural failure, cladding failure and air qualities issues. He explained the need to carry out wind tunnel tests and the limitation on wind codes. Wind load will be difficult to predict for irregular (complex) building shape, surrounding building interference, complex terrain, lack of resolution by building codes and computational analysis.

He advised doing the wind analysis in the early stages of a project (during pre-concept design) as this will allow greater flexibility in the framing and will have the least cost impact on the project. If done during the end cycle of a project (during post occupancy stage), it will only allow minimum changes to the framing and at the same time, it will prove costly to do so.

He suggested that the designer use a holistic approach that combines climate time history, wind simulations and solar simulations to create a comfortable pedestrian zone that will promote walkability.

Mr. Sudeesh Kala then gave an overview of the wind tunnel test and pressure taps located inside an aerolastic model and testing of Burj Khalifa, the world's tallest building. He explained that vortex shedding can drive a structure into oscillation and, if the vortex shedding frequency matched the resonance frequency, the structure will begin to resonate.

Ir. Dr Ng presents a memento to Mr. Sudeesh Kala

He said that to mitigate the effect of wind force, one can adopt shape optimisation such as corner softening (chamfered corners), tapering, varying cross-section shape, spoilers and increasing permeability (openings). He then presented a case study where, by introducing corner softening in Taipei 101 Tower (Taiwan), the base moment reduced by 25%. He also presented a few more case studies, including The ICON Complex (Indonesia), 151 Incheon Tower (South Korea) and US Airforce Memorial (Arlington, US). Apart from shape optimisation, he further advised the designer to also increase the mass towards the top of the structures, increase structure stiffness and increase damping to minimise wind induced problems.

Mr. Sudeesh Kala said that traditionally, most designers will adopt the acceleration criteria that the 10-year peak acceleration shall not exceed 20 milli-g. Lastly, he talked

about the damping of structures: Inherent damping and supplemental damping.

Inherent damping was further divided into external and internal categories. Supplemental damping systems included solid mass type, water/liquid type, semi-active damper and active damper. Factors affecting the selection of dampers included ease of inspection and maintenance, the sensitivity of the dampers as some might not be suitable in low-moderate wind events, cost effectiveness and space constraint.

During the Q&A session, Mr. Sudeesh Kala answered and clarified in detail the questions raised by the participants. Then Session Chair Ir. Dr Ng thanked the speaker and presented him with a token of appreciation on behalf of CSETD.

Based on feedback, most of the participants felt that Mr. Sudeesh Kala was well equipped and very knowledgeable about the topic presented. The talk was delivered in a simple layman concept. ■