Advanced Surveying Techniques for High-Rise Construction: Enhancing Precision and Sustainability

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SUMMARY

Urban construction is significantly shifting towards vertical development, with a focus on high-rise and super high-rise buildings. This trend is driven by the increasing need for efficient land use in densely populated cities with the goal of creating more sustainable and versatile environments.

Increased vertical developments make it more important than ever to effectively consider a range of impacts on high-rise buildings, including wind loading, live load from construction, and thermal expansion. This article explores the crucial roles of survey control and deformation monitoring during construction and throughout a building's lifetime, including discussing challenges and highlighting the importance of real-time data, which ensures accurate positioning, whilst validating structural integrity and stability. We compare the traditional survey control transfer process using an optical level, total station, and/or plummet to an active survey control alignment system for tall buildings. Active survey control is a real-time system, used for positioning, including GNSS and IoT geotechnical sensors, which automatically resolves positions to the high precision required for gridline stakeout process.

Additionally, we address the challenges of dynamic positioning of tall buildings, referencing case studies of notable high-rise buildings, such as the Central Park Tower and One World Trade Center in New York, 22 Bishopsgate in London, and the Burj Khalifa, which illustrate successful implementations of these techniques.

The article also discusses the workflow and solution developed by Leica Geosystems to aid high-rise buildings construction and emphasises the automated and autonomous aspects through data collection, transfer, processing, analysis and reporting.

Intelligent use of active survey control supported with automated deformation monitoring allows for higher accuracy, faster operations, and supports safety with sustainability through more efficient and lean construction.