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Tall Buildings: Imaginative Façade Solutions

Façades simply taken in isolation can be complex. A combination of design, engineering, fabrication and installation expertise is important to address all aspects of façade design and construction.

But when designing tall buildings this multi-disciplinary approach is even more integral to successfully tackling the key challenges faced by architects, contractors and developers:

Aesthetics: Tall buildings by their very nature are created to make a statement. Developers and building owners often use them to create an identity for their brand and so architects and structural engineers are increasingly being faced with challenges of how to build complex shapes and façades. Well-engineered building envelopes help define a city skyline and make that statement both day and night.

Strategic thinking and dialogue between the architect and façade consultant is essential in realising the architectural vision. Often architects will design in 3D without knowing whether something can actually be constructed or not. Early engagement of a façade consultant to work collaboratively from the project outset can save on unnecessary design time and abortive costs.

Although the Telkom Tower in Jakarta in Indonesia, at first glance, has a complex-looking façade, close collaboration between architect and façade consultant has actually resulted in the façade only having four basic angles. Its form was designed as a response to the site's dynamic conditions and sightlines to and from the surrounding city. Starting as a square at its podium base, the form is inflected as it climbs 45 storeys to the crown. No floor plate is the same.

By streamlining these angled facets to four basic groups, the façade system is simpler and therefore more cost-effective. To achieve a complex façade, you don't always necessarily need a complex solution.

Performance: A building's performance is intrinsically linked to the building envelope's performance. Taller buildings equate to a larger footprint for heat gain or loss. Since HVAC equipment and system sizing is dependant on the heat flow through the façade, it is important to have an energy efficient façade. Less heat gain (or loss) through the façade means less energy consumed in order to cool or heat a building.

The 309m-high Pearl River Tower in Guangzhou, China boasts a high performance façade that generates its own energy via building-integrated photovoltaics and a subtly sculpted form that drives wind into turbines at accelerated speeds.

Its aerodynamic form funnels the wind at high velocity through to four turbine inlets on the façade located on the 25/26th and 49/50th floors. These rapid winds will in turn power the integral wind turbines to generate energy for the building's heating, ventilation and air conditioning systems.

Other high performance solutions include a double-skin curtain wall that is embedded with solar panels to convert the sun's energy into electricity and photo-electric sunshades to maximise natural daylighting.

Engineering: Taller buildings require its facade components to be engineered for extreme wind and seismic events. A holistic dialogue between architects, structural engineer and façade consultants can ensure that suitable façade supports and setback lines are maintained for cost-effectiveness. Equally understanding the access needs for the roof can help determine appropriate loads for the structure contributing to a well-designed façade that can be maintained properly.

The 310m Ocean Heights in Dubai is one of the top five tallest residential buildings in the world. It is considered a 'super slender' building with an aspect ratio of 9.2:1.

The design was achieved by twisting the floor plate at every level to create the curved elevation. As it rises, the tower's floor plates reduce in size, allowing the rotation to become even more pronounced.

We have designed what the industry would term as a "true-warped" type unitised curtain wall system through cold-bending of glazed panels, to achieve the distinctive silhouette. Engineering the façade system involved a much more rigorous set of design strategies compared to conventional unitised curtain wall systems.

Quality control for longevity: Getting façade details right is essential for high quality tall buildings. This is important as it ensures the durability of the building. Since buildings and its façades need to perform for 50 year or longer, quality control of the systems during fabrication and on-site is imperative.

Choosing façade systems that can be fabricated off-site in modules, such as unitised systems, enables quality control to be preserved in a factory situation. These unitised panels are then transported to site and installed with little site work required.

Choosing smart materials also contributes to the façade's longevity. Understanding their limitations in terms of finishes, size, performance and cost will determine their cost-effectiveness and suitability for the façade system.

Anodised aluminium, for example, provides a hardy and permanent finish which minimises maintenance requirements. It is also much cheaper than a coated aluminium finish. Suitable for buildings in temperate continental climates, it wouldn't be an appropriate solution for a tropical environment, where it would deteriorate faster over time.

It is very important for an experienced façade consultant to be on board early along with the other project consultants in order to avoid abortive work for the building envelope. With a holistic and proactive process, the design becomes easier and faster to realise, leading to happy consultants and ultimately a happy client. Proper integration also helps increase the lifespan of the façade while innovative problem solving can help counter emerging trends in architecture and materials technology.

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Images available on request