Croc around the Block: Can Crocodilian Adaptations Reduce the Wind Loads on High-Rise Buildings?

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The past few decades have seen an exponential increase in demand for high-rise buildings. However, the constant motion of tall buildings makes them more susceptible to wind loads - reducing structural safety and health of occupants. In fact, approximately 43% of occupants have reported diagnosable symptoms of a neurological impairment disorder called Sopite Syndrome as a result. Furthermore, the use and wastage of excess structural material is damaging our environment. The production of concrete alone is responsible for up to 8% of the worlds carbon dioxide emissions, as well as significant freshwater consumption. Hence, there is a need to mitigate this excess use of structural material with simple, cost-effective aerodynamic modifications to reduce wind loads including both drag and crosswind forces. Nature provides a possible solution as seen in the dermal exoskeleton of a crocodilian known as bony scutes (knobs), which reduce the forces of drag and cross-currents on a swimming crocodile. In this project, these knobs with simulated on and around the corners of a tall building model to investigate how this aerodynamic adaptation can reduce the buildings overall response in strong winds. To investigate, model tests were run in a boundary-layer wind tunnel using one model with four different configurations of Perspex knobs. It was discovered that the addition of knobs reduced the base bending moments by at least 8% and the acceleration by at least 11% which will, in turn, reduce cost, minimise environmental impact and potentially improve the lives of the millions of people who interact with tall buildings daily.

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