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**StructuralEngineers**

# Structural use of fibre polymer composites

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# Foreword

What we now call 'advanced composites' utilise highly-engineered straw made of synthetic mud, glass fibres, carbon fibres, aramid, etc., and synthetic resins to create what are today the highest strength-to-weight ratio materials commercially available. The worldwide composite industry is worth almost \$50 billion and now spans every sector of manufacturing from aerospace to mining; pushing capabilities far beyond non-composite systems.

Meanwhile the construction industry, the largest of them all, has barely acknowledged this 21st Century material. There are many reasons for this — one is the inherent and justified conservatism of our industry. Another is that our means and methods have traditionally taken little account of weight, which is one of the main advantages of composites. In addition, the material's mechanical properties can be 'designed into' literally hundreds of possible combinations of fibre type, weight, direction, and resins; which makes them complex. Finally, building codes and standards internationally, do not make provision for easy adaptation of new material systems.

However, all that is changing. The benefits of fibre polymer composites (FPCs) are finally being discovered. Lightweight means less material and less material means lighter weight systems. Inefficient buildings are being replaced with more opaque façades, and FPCs' extremely low coefficient of thermal conductivity is being used to minimise thermally inefficient aluminium curtain wall frames. Elevators are reaching higher heights with carbon fibre cables; concrete can use FPC rebar instead of steel. Tall buildings are amplifying the importance of lightweight systems, and earthquake codes are becoming more sophisticated and widespread. Engineers will increasingly see these materials specified or designed into buildings and infrastructure systems. Those who are familiar with their unique properties will be ready. Those who are not may find themselves trying to apply traditional material assumptions, leading to inefficiency or worse.

*Structural use of fibre polymer composites* not only provides an introduction to these materials, but offers a road map for engineers and other construction professionals to follow as they grapple with yet another challenge. As usual, early adapters will reap the greatest reward, provided they do so with their eyes wide open and their knowledge base founded on facts and experience.



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