



WOOD, A MATERIAL FOR OUR TIME

As the 21st century unfolds, architecture stands at a crossroads. Until now there has been no reason to challenge the supremacy of concrete and steel as the materials of choice for high-rise buildings, but in the past decade our evaluation criteria have become more complex. The core tenets of 'commodity, firmness and delight' first proposed by the Roman architect Vitruvius 2000 years ago as the prerequisites for an ideal building, now fall within a framework of pressing global imperatives that are daunting in both scale and scope. The practice of architecture must now encompass the issues of climate change, population growth, and a global housing shortage.

In the spring of 2015, the National Oceanic and Atmospheric Administration (NOAA), a scientific agency based near Washington, DC, announced that changes

in the Earth's climate system had reached a significant and disturbing milestone. For the first time since the NOAA began measuring the concentration of carbon dioxide in the atmosphere at 40 sites around the globe, the average of those monthly measurements exceeded 400 parts per million (ppm).

According to the NOAA, this represents an increase of approximately 120ppm since industrialization began about 200 years ago. As we know, the rapid rise in CO₂ emissions has been driven by technological development, population growth and the commensurate increase in fossil fuel consumption. However, the accumulation of CO₂ and other greenhouse gases in the atmosphere has not been linear, as 60ppm of the increase has occurred in the last 50 years, and 7.5ppm in the last three years alone.

At 400ppm, the atmospheric concentration of CO₂ is at a level not seen on Earth for millions of years and the implications are significant. In the words of Dr. Erika Podest, carbon and water cycle research scientist with NASA: 'This milestone is a wakeup call that our actions in response to climate change need to match the persistent rise in CO₂. Climate change is a threat to life on Earth and we can no longer afford to be spectators.'¹

Implicit in Dr. Podest's statement is the assertion that we cannot manifest the changes that are necessary to stabilize the climate system simply by fine-tuning our current way of doing things – rather we must completely transform our commercial and industrial practices to radically reduce, and ultimately eliminate, their carbon footprint.

Also in the spring of 2015, two devastating earthquakes in Nepal, resulting in the collapse of hundreds of buildings and the loss of more than 8000 lives, came as a tragic reminder of the substandard conditions in which far too many people in the developing world live and work. As with climate change, the statistics are alarming. UN Habitat has estimated that 1 billion people (one in seven of the world's population) currently live in slums, and a further 100 million are homeless.²

As the world population continues to increase, it is projected that we will need to construct 3 billion units of affordable housing over the next 20 years. The vast majority of these will be required in the cities of the developing world, where population growth is taking place most rapidly.

At first glance the challenges of climate change and world housing might appear to be unrelated. Of the two, climate change receives more attention in the developed world, as its environmental and economic effects are felt directly in the wake of increasingly frequent hurricanes and floods, droughts and forest fires. By contrast, while access to adequate and secure housing is recognized by the United Nations as a universal human right, it is not a daily concern for most people in the West.

The reverse is true in the developing world, where vast numbers of people live at or below the poverty line, and for whom the overriding concern is the day to day search for enough food to eat and a safe place to sleep. Understandably, for those living in such circumstances, the mitigation of climate change may be so far beyond their control that it is nothing more than an abstract concept.

However, leaders in the sustainability movement increasingly believe that the solution to the environmental crisis is inextricably intertwined with issues of equity, democracy and social justice – not just within national boundaries, but across the world. This position was eloquently summarized by Andrew Ross in his 2011 book *Bird on Fire*, when he wrote: "The task of averting drastic climate change might be described as an experiment – a vast social experiment in decision-making and democratic action. Success in that endeavour will not be determined primarily by large technological fixes, though many will be needed along the way. Just as decisive to the outcome is whether our social relationships, cultural beliefs, and political customs will allow for the kind of changes that are necessary. That is why the climate crisis is as much a social as a biophysical challenge, and why the solutions will have to be driven by a fuller quest for global justice than has hitherto been tolerated or imagined."³

To frame the challenge in architectural terms, approximately one third of global greenhouse gas emissions are attributable to the construction and operation of buildings. The Intergovernmental Panel on Climate Change (IPCC) has estimated these emissions increased at an annual average of more than 2% between 1971 and 2004. Historically the majority of GHG emissions were generated by the highly developed countries of North America, Europe and Central Asia. However by 2030, it is projected that these emissions will be surpassed by those from developing countries, and overall emissions will be almost twice the 2004 levels.⁴

The production of our most widely used construction material, namely concrete, is already responsible for between 5% and 8% of global GHG (Green House Gas)



emissions. We produce approximately 3 tonnes of concrete per year for every person on the planet. Although this figure also includes concrete used in a variety of infrastructure applications, it nonetheless represents a significant proportion of the emissions attributable to the construction and operation of buildings. As for steel, while it is less carbon intensive than concrete, and is relatively efficient to recycle, the production of steel accounts for about 4% of global energy use.⁵

To address the housing shortage, construction activity in the developing world will have to increase exponentially, yet our current materials and technologies cannot deliver this increased volume of construction without grave negative consequences for the environment. If we were to proceed with 'business as usual', the increase in construction activity would generate incalculable quantities of greenhouse gases, and a potentially catastrophic acceleration of climate change.

While reducing the operating energy required to heat and cool buildings is dependent on regionally based solutions that respond to the particularities of local climate, reducing the energy intensity of building construction can be achieved using a universal approach. The typologies of mid and high-rise urban housing are essentially the same everywhere, and currently realized using a combination of load-bearing concrete masonry and concrete or steel frame systems. The only material we have available to us that could deliver housing solutions on the scale required, and at the same time reduce the GHG emissions associated with construction – is wood.

New massive wood products such as cross laminated timber (CLT), together with computerized design and fabrication techniques have accelerated the development of new approaches to building with wood. Calculations have indicated that some of these approaches may be applied to structures in excess of 40 storeys. Although research and development of these new approaches is concentrated in Europe and North America, the implications for the global construction industry are profound.

The expansion of wood construction at this scale must be predicated on the exclusive use of material harvested from independently certified, sustainably managed forests. Only third party certification provides the necessary guarantee that the rate of wood harvest does not exceed the rate of forest regeneration, and will therefore not result in deforestation and further contribute to climate change.

The purpose of this book is to present the arguments in favour of 'Tall Wood' buildings and to showcase completed projects that demonstrate the applicability of this technology to construction across a wide range of building types, and in a variety of physical and cultural contexts.

While Tall Wood construction can only ever be part of the solution to the social and environmental challenges we face, its adoption around the world would represent the kind of transformational thinking and cooperative action that will be essential if we are to restore equilibrium to the world's climate system, and eliminate the inequities that have contributed to our current problems.

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