5. Influence the brief

Time for a structural change?

To design more sustainable buildings, big decisions need to be made early in the design process. Could laying out the structure to a 300mm planning grid reduce embodied carbon, enable the circular economy and still retain the uniqueness of design, asks David Treacy.

Every building is different, with different locations, different uses and different layouts. Since the introduction of computer-aided design, we have been able to offer ever more bespoke solutions. Advances in off-site construction techniques are allowing us to mimic this project specificness in factory-built solutions. But how is this sustainable, when it requires us to have to choose which areas of design to focus our limited design time and budget on, resulting in inefficient overdesigns?

In the recent past, architects would plan the outline of a building to the nearest 300mm (which allowed for a brick facade). What would happen if we returned to this grid and laid out the structural grid to the same increments?

Could we still achieve the same brief within the site constraints? If the average person is 300mm deep, couldn't we still design great spaces for people with the structure set out to 300mm increments? We work on projects that are typically at least 100 times as large as this increment, so it seems obvious that we can still design unique, beautiful buildings that are based on a 300mm grid. Perhaps this might even enable more flexibility in design by enabling a standardised approach to fit-out and finishes?

By collaborating early with the client, architect and, ideally, contractor, we would have more chance to lay out the structure rationally. Repeating grids would lead to higher utilisations and more sustainable designs which could be reused on other projects. It would allow for a greater choice of structural systems, including off-site techniques. A recent McKinsey report[1] highlights the fact that sustainability is not the only challenge facing the industry. Skills shortages, productivity targets, and cost increases are all expected to drive the adoption of off-site techniques, which would alleviate these problems.

By advocating a 300mm planning grid, we would also drive off-site manufacture towards more material-efficient solutions. If the methodology was adopted widely, a natural trend would occur towards a small number of span combinations covering perhaps 95% of a building's space (we could even advocate using specific span arrangements that we know work well).

This would allow a shift in focus from designs that have to cover all load combinations, to designs that cover just a few. It would also allow much higher utilisation, and eventually reduce the material quantity with more efficient structural systems (think fabric formwork, trusses instead of beams, etc.). All of which would reduce embodied carbon.

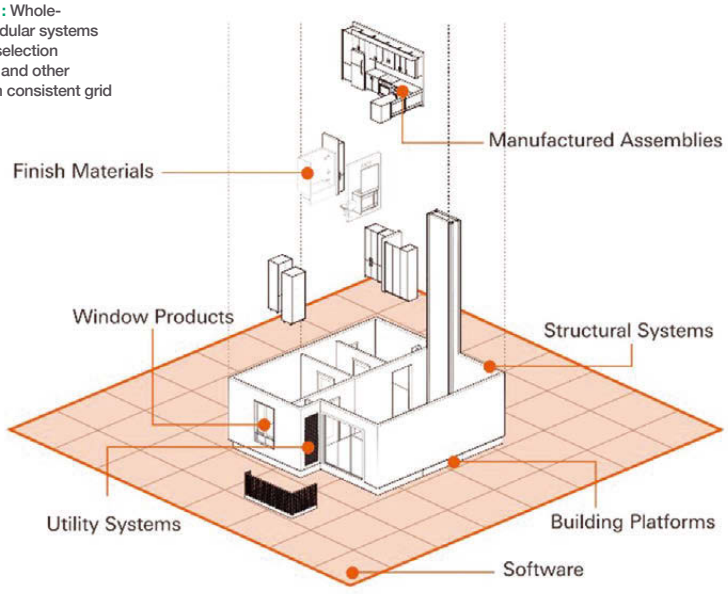
Skanska's BoKlok system boasts a 200kg/m^2 reduction in embodied carbon compared with a concrete-framed building[2]. Similarly, the approach Bryden Wood has pioneered with Office 1.0 reduces embodied carbon (20%), cost and time on site[3].

A more regular and orthogonal geometry would allow a framework for other parts of the industry to innovate too. Modular M&E systems, prefabricated facades, or internal partitions or bathrooms would have greater clarity of what is required, allowing a focus on reducing embodied carbon and materials while still achieving the technical requirements.

Katerra[4] has successfully led this whole-building modular approach in the USA, providing structure, services and finishes on a consistent geometry within its system **(Figure 1)**.

And what of the circular economy? With standardised loadings and geometry, we would ultimately have more flexible buildings – less bespoke solutions are easier to adapt to future changes of use. It would also enable reuse of old components in the future, with the knowledge of common spans reducing the risk of storing old sections. Standardised heights allow for easier replacement of facade and fit-out components (even using refurbished items), and this off-site modular construction would of course integrate easy methods of dismantling buildings.

FIGURE 1: Whole-building modular systems allow easy selection of structure and other elements on consistent grid



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Conclusions

Perhaps the time is right to reconsider how we design buildings? Which is preferable: designing bespoke solutions every time, or trying to standardise our approach? Which one will allow widespread adoption of off-site methods? Which one will reduce embodied carbon most, and which will encourage innovation and the circular economy?

I believe that we can still build beautiful buildings that meet the client's ambitions while advocating for a more uniform approach **(Figure 2)**. A consistent grid across projects gives advantages for both lean design and future reuse – saving carbon now and in the future.

This is a climate emergency, and with only 10 years to halve emissions globally[5], we need to make radical changes. Perhaps the first and simplest step is to stop trying to do things differently every time and start working within the same geometric parameters.

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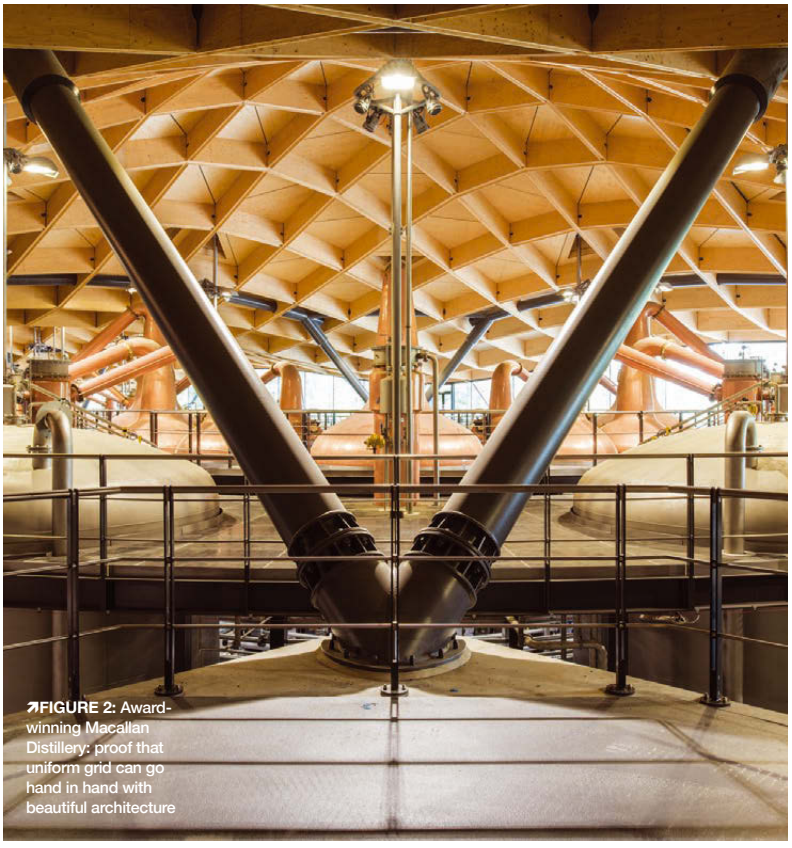

FIGURE 2: Award-winning Macallan Distillery: proof that uniform grid can go hand in hand with beautiful architecture

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