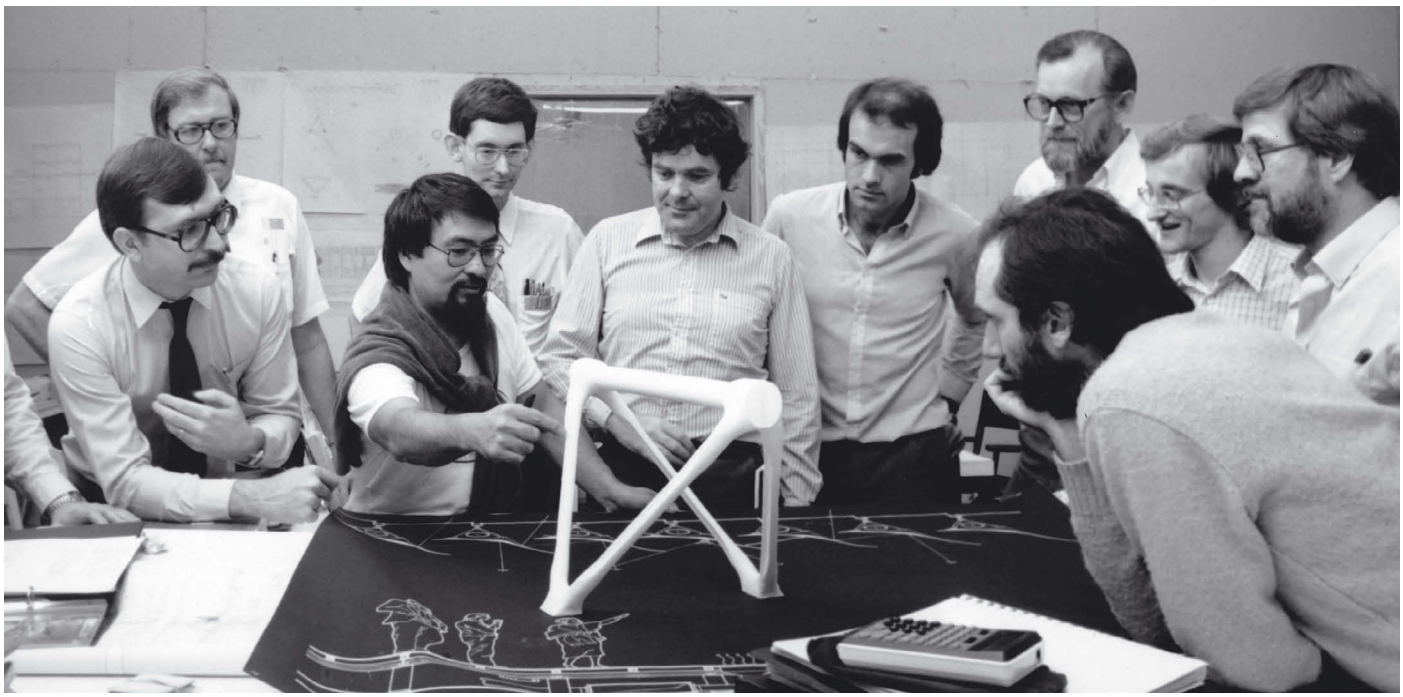
5.Influence the brief

Persuasion and influence in a climate emergency

William Algaard presents ways in which structural engineers can help shape the direction of a project by confidently and constructively sharing their expertise in a language that client and architect will understand.



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As structural engineers, it is our responsibility to develop structures with increasingly lower embodied carbon as part of our commitment to the climate emergency. To accelerate this, we need to employ the full breadth of our skills. It is clear that we should be completing our calculations and specifications with diligence and attention to detail to realise the client and architect's ambition with resource- and carbon-efficient solutions.

However, we have the opportunity to go beyond responding well to defined problems. We can step up and leverage our impact much further by influencing decision-making upstream. If we can help shape the direction of projects on a strategic level, our scope for positively influencing the outcome is greatly enhanced. We should rise to the challenge and seek to influence the brief and direction of projects to be more effective in our response to the climate emergency declaration.

↗**FIGURE 1:** Some of the best-known structural engineers of the past, such as Peter Rice (centre, in discussion with clients and architects on the Menil Collection, Texas), were highly successful influencers

Learning from others

While some structural engineers of the past – such as Isambard Kingdom Brunel and, more recently, Peter Rice **(Figure 1)** – were renowned for their powers of persuasion and influence, being proactive in influencing a project's direction is not always our natural role. Clients and architects may be natural persuaders and we are used to responding professionally to their requirements. To start influencing them effectively, we can think in reverse and take a leaf out of their book. Architects influence clients and engineers all the time.

Good architects take the time to explain why particular architectural aspects are important, describing how the user experience is impacted, how the space will feel and effectively building a business case for their solutions, which might be more costly and less structurally efficient than others.

They convince us and clients why certain aspects really matter and thereby get us pulling in the same direction despite this deviating from the more obvious structural solutions. This might come more naturally to architects and clients, but as structural engineers we should not underestimate our opportunity for influence and thereby increased potential for impact on project outcomes.

Knowledge – the basis for positive influence

Our ambition should be to contribute decisively to the design leadership and to be trusted advisers who effectively influence the direction of projects. We should be consulted as a matter of course on sustainability drivers and the recommended direction of each project; implicitly helping shape its direction and outcomes. The ideal time for influence is before the client has formed a project brief or before the architects have started considering how to respond to one **(Figure 2)**.

Realistically, getting to a position of influence as a trusted adviser is a long journey over years or even decades. Clients and architects will trust you when you give clear and justified advice consistently over a long period. Understanding and acknowledging the big picture and other project drivers; that it is not just your discipline/agenda that is important. They will expect you to provide advice based on deep technical knowledge, experience, thorough studies and targeted work. Patience and perseverance are needed to build up a level of respect and trust where you can legitimately challenge, and contribute to, their ideas and solutions.

The ambition to become a key adviser may be a long-term goal. But we can also think in terms of smaller and more immediate steps to leverage our influence on the project direction to help achieve more sustainable outcomes. The best place to start might be to answer the question: if you were the client or architect, what would you do differently to improve the efficiency of the structure and reduce the embodied carbon?

At concept stage, ask yourself questions like:

- →| Are the load paths direct and efficient given the project constraints?
- →| How fixed are the project constraints? (e.g. Are these objective site limitations or more subjective based on client/ architectural generosity, preference, etc?)

Envisage the problem without the constraints: is the impact of the constraints reasonable and proportionate? Consider some basic structural efficiency factors: will the proposed configuration be governed by strength or are there significant deflection-governed elements such as long spans or cantilevers? What are the material limitations? Can adjustments be made now to make a timber scheme viable? During scheme design, more detailed negotiations on element depth and efficiency may take place, which will have some impact on the embodied carbon. Even when in the contractor's hand, there may be opportunity for new ideas, tuning and improvements.

However, more fundamental project questions, which are typically decided at the project definition stage, are likely to have a bigger impact. These are questions such as: is this the right site for the project? For the site, is this the right building? As structural engineers, we have views on this, but other project participants do as well.

Our voice will be more convincing if we speak with an understanding of the broader project considerations. Before criticising a structurally intensive building like an office tower, do we appreciate operational advantages the project may offer in a dense city centre well served by public transport compared with a structurally efficient out-of-town business park? How users get to a building can be more important in terms of climate impact than what the building is made from.

To effectively and positively influence the project direction we need to know the efficiency drivers. These may appear obvious but are not always so apparent. We should spend more time thinking about this, and think more broadly than based on the project constraints presented to us.

In a standard building, what is the impact of span versus structural zone, what are practical limits for timber solutions, etc? In a tall building, what are the tipping points for material viability, system efficiency and solution recommendations? What is the impact of an eccentric core, increased slenderness or wind sculpting at the top?

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Having done the homework and been at the table from the start, we have a greater chance to influence the project in a more sustainable direction. The best opportunity may be the very first design meetings with the client and architect.

Communication – the means for effective influence

Knowing the opportunities and quantifying the benefits of the challenged brief or challenged solution is critical. But effective communication is also required for successful influence. The approach and style may be personal and based on the relationship, but a suggestion might be to put the advantages in terms that the client or architect appreciates.

Absolute or percentage saving in concrete, carbon or steel is a start. Reputational advantages and value perception of timber structures can be highlighted. But often, the simple financial and budgetary benefits are the clearest. Less material = less cost = less carbon. Save on structure to allow a nicer facade. Try speaking their language, whatever that might be.

It may also be helpful to convey clients' and designers' scale of carbon impact in their professional capacity compared to their private impacts. Most professionals have a desire to be carbon-responsible in their private life. But are they aware that extravagant design choices can outweigh a lifetime of carbon-conscious private life? If you compare a vegetarian diet to shorter spans, the spans can have orders of magnitude greater impact[1].

Keep in mind the immediate impact of your own decisions. If reviewed by an external competitor, could they present a more economical (less resource-intensive) scheme for the project? But we should go further and aim to get to a position where we can ask our architect: if a carbon-conscious architect reviewed the project, what changes or tweaks might they have suggested to unlock resource reductions?

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↘FIGURE 2: Early design meetings with architects and clients, at the 'fat pen and foam model' stage, may offer the best opportunity to influence the project to achieve sustainable outcomes. Example shows early design meeting on Whittle School and Studios at Renzo Piano Building Workshop, Genoa

Case study: Fubon Xinyi A25 tower, Taiwan

Fubon Xinyi A25 **(Figure 3)** started as a design competition. Working with Renzo Piano Building Workshop during the competition allowed Arup, as structural engineers, to place a strong focus on structural efficiency from the start. We explained how efficient design would not only strengthen our competition entry but also the viability of the project, as is typical for many tall building projects.

We conveyed indicative cost ranges for the primary structure based on the efficiency that could be achieved. With a tall tower in a typhoon and seismic zone, the savings that could be realised by the most efficient forms made a convincing argument. Budget is always a limitation, and the architectural desire for a more costly active facade meant the team unifying behind an ambitiously lean structural design.

This design included embedding highly efficient buckling restrained braces in the architecture to mobilise the perimeter columns to resist typhoon and seismic overturning moments, and providing damping for comfort rather than adding structure for stiffness. We identified efficiency drivers and worked throughout the process to maintain high-efficiency solutions, providing early estimates and commitments on steel tonnage.

Even though the design changed significantly during the competition, such as from a circular to square plan, we provided ongoing input on design changes to help maintain or exceed the efficiency targets. Sometimes this was successful, such as by slightly reducing the height and slenderness when there was an opportunity for this, or by modifying notched corners to improve global wind response long before wind tunnel testing could be completed to confirm the advantage.

Noding out braces inboard of the corner columns helped distribute reactions on the foundations, saving raft thickness and pile length. However, on other items such as the five-storey glass screens on top of the tower, these were regarded as fundamental to the architecture despite an evaluation of the potential column size reduction. As so many other key efficiency drivers were maintained, the building was still realised with one-third lower steel tonnage than the local benchmark.

FIGURE 3: Fubon Xinyi A25, Taipei, Taiwan, now under construction

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A place to start

At the next project opportunity, ask yourself what you need to do now to make sure you can be proud of the carbon intensity at the end of the project. Be ahead of the game – share the aspirations, commit to ambitious targets together with your architect and client. Be prepared to say the direction is not right, but also suggest a better direction that is close to their initial aspirations. The approach and style are always personal, but might be along the lines of '... that's possible, but would be very inefficient, costly and have a high embodied carbon content. If we did this instead, you could have the same grid, just an extra post here'.

Another approach is answering questions that are not asked, such as:

- If you had asked me what the lowest-carbon solution for this project is, I'd have said repurpose the building that's already there, or take a floor off and add a few columns to make timber a competitive solution, or reduce the basement slightly to fit within the existing retaining walls.
- If you had asked me how to save £60 000 on the steel frame, I'd have suggested adding a column here to allow lighter and shallower beams.

Or you could state facts or offer ideas at unexpected times, such as:

- Did you know that the embodied carbon in this column transfer is greater than our carbon savings for all those overseas project meetings we cancelled during the Covid-19 pandemic?
- If we speak to the MEP team again after these changes, maybe the integrated solution will be possible, which would save almost 30% on the steel tonnage.

We can also ask questions that are not typically expected from the structural engineering team, such as:

- How would your business plan change if we refurbished the existing building rather than rebuilt?
- Have you factored in the added reputational value potential of the low-carbon solution, or the rental premium potential?
- What's most important, that large column spacing or the openable facade? The cost plan shows that only one will keep us on budget.

Don't expect to win every battle – design is a compromise. Focus on the most important aspects and be prepared to give something back as part of a constructive and collaborative relationship. Long-term opportunity for positive influence will be strengthened by showing an understanding of the need to balance the broader project drivers. While our ambition should be to have strong strategic input on all projects, every step of positive influence has an impact, and is a step in the right direction of sustainable or restorative design.

HAVE YOUR SAY

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REFERENCE

1) Arnold W. (2020) 'The structural engineer's responsibility in this climate emergency', *The Structural Engineer*, 98 (6), pp. 10–11