

Architecture and Structure

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I am often asked for my views about the relationship between structure and architecture. Is that because the structure in our work assumes an unusual importance - is our approach different from that of other architects - now or in the past? Does it have something to do with the nature of our work and in the relationship that we create between the structure and the spaces which determine the appearance of the buildings both inside and out.

It is difficult for me to pick apart a process of designing that seems so obvious that I take it for granted. But maybe it is important to state the obvious - to say that the structure is going to be influenced by the geography, even the climate of a place as well as the needs of the people who generated the building in the first place. How else could you explain the big-span structural steel 'trees' of London's third airport at Stansted happening at the same time as the concrete vaults of the Lycée in Frejus, in the South of France.

At Stansted the base or 'trunk' of the trees are literally rooted in the distribution of air and artificial lighting from the undercroft below. The 'branches' spread out to support the most elegantly minimal roof, whose function is only to provide shelter from the elements and to let in light from the sky above. Compare this with the massive roof and supporting structure for a traditional airport with its need to carry the weight of the mechanical equipment above the roof and below it all the usual ductwork, fluorescent lighting, cables and suspended ceilings. By comparison our concept for Stansted is radical even if it does mark a return to an earlier tradition of less mechanistic buildings - to suggest a newer generation which are elegantly comfortable but also energy conscious.

It is important to note that the motivations here are not just for something that will work better, and perform more economically, but also for something that will feel better for those who use the building. The visual dimension of a structure is also its spiritual dimension: how it will look, and how it will work, become conceptually inseparable throughout the process of design.

Another way of looking at the structure in our building is that it is one of several tightly integrated systems. For example in the Lycée at Frejus the thermal mass of the heavy concrete vaults is as much a part of the ecology of the building as it is the essence of the structure. Even the roof is a separate element, which hovers above the vaults to protect them from the sun and to encourage a movement of air as part of the solar stack effect within the building. The idea of a double roof, thermal mass and natural ventilation by cooling breezes has its roots in the traditional architecture of Islam.

In both of the examples that I have chosen the structure uses the most commercially available local materials in the most economic manner. There is a tradition of steel structures in Britain but not in the South of France, where concrete is much more sensible. In each case the structure is locked into the environmental concept for the building which in turn cannot be separated from the climate of its place. The response to a Northern latitude should be different from that of the Mediterranean region. So in objective terms the structure in almost all of our projects is doing much more than just holding up the building.

The integration of the structure is central to what we strive to achieve as architects and this is only possible by accepting the engineer as a creative force in the design process. Ideally these engineers are individuals who will share from the outset the values and aspirations of the rest of the team. Given strong design leadership, there is no conflict in this approach. The strength of a powerful team should never be confused with the impossible problem of trying to design by committee. Individuals and teams alike can share a common passion - committees by their nature are denied such a creative pulse.

But there is also another dimension to structure and that is the way that it relates to the architecture of the spaces. It does not matter whether a building is about clear open space or whether the space is divided up and cellular by nature: the structure will impart its own order – it will literally structure the space to make it more legible and human in its scale. Perhaps the structure might read through on the exterior to impart an urban scale - to profile the building on the skyline of the city. The most obvious example of this from our past projects would be the Hongkong and Shanghai Bank's headquarters, in Hong Kong, and the Century Tower, in Tokyo. In both cases the structure allows the shape of the plan to change at different levels up the height of the building. This articulation creates a hierarchy of order, which thereby resolves the issue of light angle restrictions on nearby streets as effortlessly as coping with typhoon and seismic forces. Thus constraints are turned into opportunities to sculpt the form of the building and in some cases to create the symbol for the place. It is significant that the banknotes in Hong Kong are decorated with images of the Hongkong and Shanghai Bank.

The symbolic value of a structure is nowhere more apparent than in the Communications Tower that we designed in Barcelona. This project arose out of the political initiative of the Mayor, Pasqual Maragall, who was concerned about the proliferation of towers on the skyline of the mountains of Tibidabo which in turn dominated the city and major views out from it. You could see what would happen if market forces were given free reign - the giants of regional TV, national TV and Telefonica would each have had their own massive towers, not to mention 30 or more other sizeable masts amid a forest of microwave dishes. The Mayor demanded one single tower and the abolition of all existing unsightly structures. He proposed that the rival companies should band together to create an organisation that would build, operate and lease out space. They would also provide public viewing platforms so that the citizens of Barcelona and visitors could view the city from a new perspective. The site was also ecologically sensitive - a protected area of forest and a nature reserve.

Our research established what a conventional concrete structure would have looked like - a tapering slip-form concrete tower, massively solid at the base, and probably as much as 25 metres in diameter. The effect on the site and skyline would have been brutal.

We started from the first principle of communication engineering - the desire for the maximum freedom offered by 'plates suspended in the sky'. The closest response would be an elegant and slender needle - hollow to carry all the heavy cables and fibre optics, but also supporting platforms aloft. The whole assembly made stable by tensile guy lines raking off to be anchored discreetly in the landscape. Integrating the aerodynamic wind forces and structural stiffness transformed the platform shape from a circle to a triangle with curved sides. The form is a revolutionary response to its site and function - but more importantly it has become a three dimensional sculpture unique to the city of Barcelona. In that sense it has become an established and popular symbol.

Like any structure it can also be described in prosaic terms. A slim, hollow concrete shaft with steel platforms made stable by three pairs of steel cables and stiffened by upper cables made of Kevlar, which is an electronically transparent material. All is prefabricated for fast and clean assembly. The thirteen platforms, equivalent to a domestic block of 25 storeys weighing 3,500 tons and providing 60,000 square feet of usable space, were assembled on the ground and hoisted up the shaft.

The important thing about the structure was that it grew from two streams of consciousness at the same time. One was the social need - the other was the technological need. Put another way it had to work well and look good - both from close-up and from afar. I suppose that is why I can never answer questions such as: 'what is more important, the function or the aesthetics?' For me they are inseparable, the one grows out of the other. This involves manipulation, massaging and finally integration, but never the imposition of one to the detriment of the other.

I would like to continue this theme of the Communication Tower. More recently we were asked by the mayor of Santiago de Compostela to design a similar kind of project for a mountain facing his city. Coincidentally the new structure would replace existing facilities, which were unsightly, and had defaced the landscape for many years. The relationship between the mountain site and the city is physically close and religiously sacred - Santiago is one of the most important pilgrimage destinations in the Christian world.

It was the symbolic importance of the site that led us to question whether there was a better alternative to a tower on the skyline. By posing such a radical question we were able to demonstrate that a horizontal platform hovering over the mountain forest would not only be more discreet and economical, but that it would do the job even better. The dialogue that created this new direction evolved out of the latest advances in the development of communications technology.

I see no conflict in embracing tradition and new technologies because for me they are both part of a single tradition. The most enduring structures, from any point in time, have always pushed the technology of the day to the limits whether they are man made hills from pre-history, the Gothic stone cathedrals of Europe, the magnificent timber temples of Japan, the mosques of Islam, humble barns or structures from ancient Rome. The list of my personal favourites would be a very long one but in every case the structure is synonymous with the appearance, both inside and out, as well as the feel, the spirit and the emotional poetry of the buildings. It is also significant that in each of these examples one can also rationally analyse the structure with intellectual rigour. That is real integration of architecture and structure - truly the art of necessity.

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