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# Façade engineering & the design teams of the future



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The façade is of paramount importance in terms of building performance and is an important architectural element, ranking alongside building site and form. It is not only the aesthetics that make the façade so significant - depending on a series of factors such as complexity, materials and finishes, performance, and magnitude and location of the project, the façade can account for anything between 15 and 25 per cent of the total construction costs and represent a substantial part of the technical and commercial risk on any given project.

The façade is the filter between the climate outside and the conditioned space inside, it determines the appearance of the building, and its performance relies on appropriate specification, design, and delivery of a multitude of components and systems. The façade/structure interfaces, as well as interfaces between different cladding packages and other special areas is "where things always go wrong". Successful projects generally depend on a high degree of collaboration across the

design team and throughout the supply chain. Where the collaboration and the contractual set up is handled competently, value can be added through excellent technical and aesthetic detailing and risk can be managed in terms of cost and programme. The competent people dealing with the façade (or the building envelope) are referred to as façade engineers and the relatively new field is becoming increasingly important as part of an integrated approach to design and delivery of buildings. Notwithstanding the impact of facades there is a lack of industry-wide regulation of the professionals in this field.

#### Society of Façade Engineering

In 2003, a group of professionals established the Society of Façade Engineering (SFE) in recognition of the need to 'regulate' the industry and introduce a system of accreditation. The SFE was inaugurated in 2004 as a Society under the Chartered Institution for Building Services Engineers (CIBSE), supported by the Institution of Structural Engineers (IStructE) and the Royal Institute of British





Architects (RIBA). The SFE was initially rather UK-centric - mainly because of the people involved in the initiative and the fact that SFE was set up in London. It was, however, always the intention to establish an international society. The membership is international and the SFE is experiencing significant growth in the regions - Notably the Middle East where the Society was launched around the beginning of 2009.

The SFE is still in its infancy with approximately 220 members, but the interest in the Society is building and the membership is expected to multiply through regional initiatives as well as a concerted effort to reach out to the membership of the supporting institutions.

There are a number of benefits of membership, such as: recognised professional status (Associate, Member - MSFE, or Fellow - FSFE); enhanced career opportunities; professional networking; events; magazine; technical forum - to name but a few. Subscription is free to all existing members of CIBSE, whereas non-CIBSE members get affiliate CIBSE membership when joining the SFE and get the benefits of CIBSE membership, for instance including free online access to publications.

Members are actively encouraged to contribute information to the Elevation Magazine of the SFE and take part in the activities coordinated through the SFE Steering Committee.

### What is Façade Engineering ?

The SFE has debated the definition of Façade Engineering and has agreed on the following wording:

**Façade Engineering is the art of resolving aesthetic, environmental and structural issues to achieve the enclosure of habitable space.**  
[\[www.FacadeEngineeringSociety.org\]](http://www.FacadeEngineeringSociety.org)

Now, there will be numerous equally valid definitions and there will be situations where the current definition is 'not quite right', but the essential point here is the fact that façade engineering bridges across the more traditional disciplines that are architecture, structure, and services.

### The Role of the Façade Engineer

The definition of the role of the façade engineer inevitably has to address the differences in backgrounds and responsibilities of the

professionals across a varied section of the industry. Different (and equally necessary) forms of façade engineering are being carried out by architects in architectural practices, by engineers in consulting firms, and by technicians in different parts of the supply chain. While there are different perspectives and the services serve different purposes, the field is common - the subject remains façade engineering.

Similarly, there will be differences in the nature of the services. The range of services constituting façade engineering is exemplified by the difference between on the one hand the design and specification of a bespoke solution, and on the other, the checking of a contractor's design against a specification.

There is also a marked difference between, say, guidance on commercially available (standard) curtain walling systems and the bespoke engineering of a solution in response to an architectural vision and a set of client's requirements.

The point here is that façade engineering covers a fairly broad range of professional profiles and professionals working across the industry and the supply chain. Add to the mix geographical and national characteristics, the fact remains that local tradition and practice dictate important differences in the role of the façade engineer, which needs to be embraced and dealt with for any international accreditation scheme to be meaningful.

At the risk of coming across as pedantic, it might be worth pointing out that the term 'building envelope' (i.e. not 'just' façade) might actually be more appropriate, given the fact that all of the interfaces need to be resolved and that the 'discipline' is not by any means limited to facades. The term 'façade engineering' is used for simplicity and because it would be pointless to discuss semantics in a time of far more important challenges.

The SFE has set out a description of the role of the façade engineer, which is being used to judge the professional experience of individuals applying for different grades of membership. With time, the description will be developed for the different regions, reflecting diversity and reflecting important aspects of the local markets and traditions.



### A Grey Area ?

In his influential work *De Architectura* (On Architecture), Roman architect Vitruvius talks about the three elements of Architecture: Commodity, Firmness, and Delight. There are interesting parallels to the nature of façade engineering in that the building envelope needs to fulfil the functional requirements and meet the specified performance criteria, while having a fundamental impact on architectural aesthetics and the intangible qualities of the resulting enclosed space.

This, then, is perhaps one of the aspects that appeal to a new generation of technically minded architects and architecturally minded engineers? There is no doubt that the nature of façade engineering can be both complex and stimulating. Appropriate application of highly

Jubilee Campus, Nottingham University, United Kingdom.  
Architect: Michael Hopkins & Partners. Copyright: Paul McMullin.



specialised skills is potentially the difference between a successful project and a less successful one.

The need for specialist input stems from the gradual transition from traditional to non-traditional methods and technologies.

Technological progress and industrialisation of the construction industry means that the role of the Architect is changing from controlling the design through a profound knowledge of materials and techniques, to a role of orchestration of a multitude of specialist skills, knowledge, and industry intelligence - possibly benefiting from façade engineering input throughout the various stages of the design process. The increasing complexity of the technology and the recognition that not many

“ It is not appropriate to attempt a 'one size fits all' definition of façade engineering. Any definition would need to reflect local variations ”

architectural practices can sustain in-house skills in every field resulted in façade engineering as a relatively new professional 'discipline'. The first façade engineering groups were set up around 20 years ago in response to the need for specialist input on technically challenging projects. Façade engineering covers the 'grey area' between the more traditional disciplines but also overlaps significantly with all of them, to varying degrees depending on the circumstances.

The scope of experience varies greatly. Sometimes the profile of individuals is referred to as 'T-shape' spanning from the tall, narrow T representing the highly specialised professional and the broad, lower T representing the generalist. Many architectural practices have a 'façade guy' or a 'specialist' or an 'experienced



Glaxo Wellcome Headquarters, London, United Kingdom.  
Architect: RMJM . Copyright: Chris Gascoigne.

colleague', who serves as the de facto in-house façade engineer within certain limits set by the scope of the Architect's work.

Some very experienced individuals are 'marketed' as Experts (as opposed to Specialists), which usually implies some significant yet undefined level of industry experience, which can be highly subjective.

**Professional Accreditation**

Based on the discussion above it is apparent that there is a need for regulation as a way of setting out the standards for the discipline and establish well-defined levels of professional experience and competencies.

The SFE works with academia and Industry at large to define and adjust the necessary criteria and standards, which with time will

become the yardstick for professionals and clients alike. Recognising the discipline is a first important step towards incorporation of the façade engineering services in the consulting services of design teams and the accreditation of professionals will ultimately prove to be an essential instrument for clients who require hitherto loosely defined types of services in connection with the design and procurement of facades, as well as various other forms of

specialist services, such as diagnostics and remedial work.

The ability of the client to demand professional qualifications seems essential, but has nevertheless been difficult if not impossible without a formal structure in place. Incidentally, besides the obvious importance of critical mass in terms of professionals effectively being accredited, having a mechanism for professional accreditation is also key to the concerted effort to raise professional standards across the industry.

Ideally the system of accreditation and professional recognition should be 'pan institutional', reflecting the nature of the discipline. Discussions are taking place between the core professional institutions and it is not unlikely that the outcome will be a broader base of membership and a stronger Society, benefiting the members as well as the institutions and the industry as a whole.

**Education**

The education of façade engineers is another important topic, which is currently being explored at international level. Universities are offering MSc courses in Façade Engineering and moving from isolated offerings to a networked approach. Again, the definition of criteria for professional accreditation is key and the SFE membership classes correspond to different levels of experience and training. There are already courses with a well-defined syllabus which covers fundamentals and increasingly incorporates aspects of integrated design in the course work.

There is a distinct difference between on the one hand the ability to pick an appropriate, commercially available cladding system in response to a set of project-specific requirements and on the other the ability to engineer and procure a bespoke solution - something which distinguishes the 'façade engineer' from a 'cladding consultant'.

These definitions are not formal and there is a sliding scale where individuals will be able to switch mode according to the circumstances.

Key to the success of the courses and the accreditation scheme is the way in which possible career paths are now being set out for aspiring and relatively inexperienced individuals to develop their skills in a structured way.



National Aquatics Centre (aka Water Cube), Beijing, People's Republic of China.  
Architect: PTW (Australia) & CSCEC & Design.  
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Again, any activity in the field of education and continued professional development needs to address the international perspectives and the international collaborations currently being formed will no doubt bring about significant benefits in this regard.

**Effects of Globalisation**

The effects of globalisation are felt in the façade engineering field in terms of multinational clients and investors, international design teams, and international façade procurement. In the current financial climate the ability to deliver projects internationally is pivotal and to this end, an understanding of local conditions and market mechanisms is paramount.

While there is a significant element of global trends and exportation of technology from the more advanced markets, any project will need to be delivered to local standards and in a competitive market, the installation of building envelopes is typically handled by a local workforce.

The combination of an increasingly global market for façade systems and local differences in procurement and design processes means that Façade Engineering means different things to different people. It is not appropriate to

attempt a 'one size fits all' definition of façade engineering. Any definition would need to reflect local variations.

**Advanced Design Tools and the Sustainability Agenda**

Over the past years, the significance of the integrated approach to design and delivery of buildings has been widely acknowledged and debated. Terms such as 'holistic design' are now commonly used and there is an increasing demand for assessment of environmental impact.

***"A design team which produces a total balanced, efficient design can help to produce a better environment"***  
**[Sir Ove Arup]**

The thinking has been around for a long time, but clients are gradually beginning to see 'green buildings' as good business and not merely an issue of corporate social responsibility or legislative requirements.

As for facade engineering and procurement of facades, we can expect to see an emphasis on the ability of suppliers and contractors to demonstrate their sustainability credentials and the characteristics of their proposed solutions.



Beijing National Stadium, Beijing, People's Republic of China.  
Architect: Herzog & De Meuron. Copyright: Arup.



A factor which is already influencing the way facades are engineered, but will be dominating the time to come, is the way advanced tools are used throughout the design process. Building information modelling (BIM) is facilitating coordination and potentially minimising interfacing and sequencing issues on site. Geometry driven design revolves around the ability to test the feasibility - technical as well as financial - of the proposed options. One example is parametric modelling.

The coupling between on the one hand architectural models representing the vision and on the other, optimisation work looking at panelisation and the buildability in detail is driving both the development of technical solutions and the skills required to deliver the final product. The overall building energy/ carbon performance is increasingly important.

The integrated design approach is essential in order to deliver low carbon designs and while exemplary projects are usually being developed where the client is visionary and willing to accept risks in pursuit of new ways, the legislation is following, introducing mandatory measures for all. In the broader context of sustainability we are seeing increasing demand for life cycle analysis as part of decision making on design projects and different environmental impact assessment methods and rating schemes (such as BREEAM and LEED) are increasingly informing and driving the design

of buildings. All of these aspects add up to the fact that façade engineers need to be capable of operating within these frameworks and offer advice in terms of the environmental impact of the proposed solutions. It also means that there will be an ever-increasing demand for professionals operating in the cross-field that is the design of building envelopes. The scene is set for façade engineering as an instrumental part of integrated design and 'high performance - low impact' building designs - also in a highly commercial context.

#### Design Teams and the Design Process

Façade engineering is an interesting example of a relatively new discipline, which bridges across the more traditional disciplines of architecture, structures, and services. Ideally, façade engineering covers the grey area and deals with interfaces on multiple levels. Successful projects depend on good collaboration and a move away from the unnecessarily risk-averse culture, which results in disciplines working in 'silos' with a high degree of inertia in the exchange of information and development of solutions.

There is a stepwise development from the disparate approach of separate disciplines through collaboration to interaction and integrated design. Integrated design can only be delivered through interaction, and façade engineering is a crucial component of that process. As more stringent requirements are introduced through legislation in an effort

to reduce net energy consumption and curb carbon emissions, there is an increasing need for interaction and integration in order to meet the design targets.

The façade engineering discipline is embedded in various aspects of the work of Architects, Engineers, and Specialist Trade Contractors and we will see an increasing need for seamless collaboration and delivery of integrated systems as opposed to elements and components. We have witnessed a recent trend of design teams going from multidisciplinary to interdisciplinary, with disciplines interacting and working closer together.

We may now start to see a further progression, leading to teams working in a transdisciplinary fashion, with design being carried out in seamless collaboration and façade engineering being the exemplary discipline executed as a naturally embedded part of the process without unnecessary boundaries. Again, it is essential that the professional qualifications are well-defined and that an appropriate system of accreditation is in place.

The Society of Façade Engineering offers a vehicle for the recognition of professionals who, through the membership classes Associate, Member (MSFE) and Fellow (FSFE), are able to demonstrate their competencies, and also as a way for clients to be specific about their requirements on important construction projects.

#### The Author

Dr Kragh is an Associate at Arup, an international firm of consultants with a global presence and a reputation for innovation and creativity in the design of built environment. He has recently transferred from London to Milan, where he is now responsible for a range of specialist consulting services including façade engineering. Dr Kragh has led a number of development projects, exploring the frontiers of building envelope technology. He is a Senior Visiting Research Fellow at the University of Bath, where he is involved in façade engineering research. Dr Kragh was elected Chairman of the Society of Façade Engineering in March 2009.

#### Links

<http://www.Arup.com>  
<http://www.FacadeEngineeringSociety.org>