

Facades: past, present and future – marking 50 years of continuous development

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To mark the 50th year of FAECF, the European Federation of the National Window and Curtain Walling Manufacturers' Associations, this paper looks back at the development of the façade, with a focus on curtain walling and asks: "Is there anything new under the sun?" While on the face of it, the building skin has performed the same functions for the last 50 years and beyond, we show that it is the detailing and implementation of the building envelope, along with our ability to integrate energy efficiency, occupant comfort and sustainability, with the aid of computer modelling, modern manufacturing techniques and improved materials, that sets the modern façade apart from those in the past. As we look to the next 50 years, we can only expect innovation to accelerate. We can anticipate greater control of the indoor environment, and more intelligent structures: structures that can share data and sense and adapt to the external conditions and occupant requirements. We will also see an increased emphasis on the circular economy and the use of robotics for manufacture and installation, presenting opportunities and threats for our members.

Keywords: aluminium, curtain walling, occupant comfort, occupant wellbeing, biophilic design, material sustainability, circular economy, durability, flexibility, digitalisation,

1 Introduction

FAECF, la Fédération des Associations Européennes des Constructeurs de Fenêtres et de Façades (the European Federation of the National Window and Curtain Walling Manufacturers' Associations), was founded in 1968 and celebrates fifty years of operation in 2018. The main objective of FAECF is to promote and defend the European fenestration industry in its chosen markets. It contributes to harmonization in fenestration standards and provides technical information to the industry.

During a moment of reflection, we wondered what was happening in the world of building facades up to 1968 when FAECF was founded. How have facades developed since 1968 up to the present day? What trends will we see emerge in the next fifty years? To try to address these questions, this paper will focus on one framing material, without which our federation would not be possible: aluminium. As the one of the pioneers of modernist architecture Ludwig Mies van der Rohe (1886-1969) put it: “The danger with aluminium is that you can do whatever you like with it; it doesn't really have any limitations.” We will also focus on one facade system: curtain walling.

Some twenty years before the founding of FAECF, James Marston Fitch (Fitch, 1948) described the building envelope as a two-way filter – “a selective, permeable membrane”. Fitch saw the building envelope as analogous to our skin, which helps our body respond to the external environment and maintain optimal operating conditions. Few of us can live in climates that allow us to be exposed to the elements all year round; usually we need clothes and we need buildings to act as the two-way interface between us and the external environment, as Fitch also concluded. From the ground-breaking curved forms of the Barcelona Trade buildings completed in 1968, to the iconic Shard standing at 309.7 m and completed in 2012 (see Fig. 1), curtain walling has provided architects with creative, flexible and sustainable solutions to their increasingly complex designs and growing end-user requirements.



Fig. 1 The London skyline featuring The Shard [source: Shutterstock.com]

In the following sections, this paper explores the development of curtain walling as our second “skin” in the following contexts: as a selective filter with respect to occupant comfort and wellbeing, material sustainability, and digitalisation.

2 Comfort and wellbeing

Since we emerged from caves and started to build homes, we have understood that buildings should protect us from extreme outdoor conditions, as well as from woolly mammoths. In Northern Europe the focus was perhaps on the need for insulation in the building envelope. But does this mean we need to go back to the caves, with thick walls and no windows? Of course not, architects increasingly recognise that facades must be designed to provide comfort by using the right materials and the energy balance concept. Educating and empowering homeowners with similar knowledge when selecting their windows, is an important campaign message for FAECF: tailored advice is important to reflect the local climate as well as the size and orientation of the windows.

2.1 Thermal comfort

To provide good thermal conditions, which are not solely about room temperature, energy efficiency is achieved with glazing by maximising solar gains in the heating season while minimising heat losses; in the cooling season solar gains need to be reduced with appropriate shading. Hence, important parameters that affect the energy balance include the area of glazing, its orientation relative to the sun and the local climate (European Aluminium, n.d.). With its high strength to weight ratio, aluminium has long been used to frame glazing and maximise the transparent area. This also provides more daylighting and opportunities for natural ventilation, also important factors for building occupant wellbeing. As Winston Churchill put it when referring to the rebuilding of the UK Parliament Chamber (UK Parliament, n.d.): “We shape our buildings, and afterwards our building shape us”.

As noted in a literature review (Poirazis, 2004), double skin facades can provide both improved indoor climate and reduced energy at the same time – if designed properly. Although the concept of double skin facades is not new, and there are many different definitions and implementations of this envelope system, there is increasing interest in this type of construction, particularly in Europe. Harrison and Meyer-Boake (Harrison & Meyer-Boake, 2003) described the double skin façade system as: “Essentially a pair of glass ‘skins’ separated by an air corridor. The main layer of glass is usually insulating. The air space between the layers of glass acts as insulation against temperature extremes, winds, and sound. Sun-shading devices are often located between the two skins.”

As recorded by Poirazis (Poirazis, 2004), Saelens (Saelens, 2002) mentions that: “In 1849, Jean-Baptiste Jobard ... described an early version of a mechanically ventilated multiple skin façade. He mentions how in winter hot air should be circulated between two glazings, while in summer it should be cold air.” Crespo (Crespo) claims that the first instance of a double skin curtain wall appears in 1903 in the Steiff Factory in Giengen, Germany. Here the priorities were: “To maximise daylighting while taking into account the cold weather and strong winds of the region ... The building was a success and two additions were built in 1904 and 1908 with the same double skin system ... All buildings are still in use.” Arguably, this structure was the first example of curtain walling, outside of shopfronts and wintergardens.

Bringing this topic up to date, Crespo (Crespo) also notes that: “In the 90’s two factors strongly influenced the proliferation of double skin facades...increasing environmental concerns start influencing architectural design both from a technical standpoint but also as a political influence that makes “green buildings” a good image for corporate architecture.” Nevertheless, as noted in a 2005 report into the state of the art for double skin facades (Streicher, 2005), an advanced façade should allow for a comfortable indoor climate, sound protection and good lighting, while minimising the demand for auxiliary energy input. Double skin facades have the potential to offer solutions for this conundrum.

Examples of double skin facades can be found in several European countries. One Angel Square in Manchester, UK, is the Co-operative Group’s new headquarters building, where more than 3,000 Co-op employees are co-located in one office for the first time. The Co-op is a consumer co-operative, owned by millions of members and the UK’s fifth biggest food retailer. The 15-storey building is a three-sided structure, designed by architects 3DReid, with a fully glazed double skin façade that curves both horizontally and vertically around the building (see Fig. 2). It was awarded the BREEAM rating ‘Outstanding’. The double skin façade along with the atrium structure used here are key to creating natural heating, cooling and lighting. In summer louvres at the top of the facade open to allow the warmed air trapped between its inner and outer skins to rise up and out of the building. In winter these louvres close so the facade can form an insulating blanket around the building.



Fig. 2 Construction of the double skin façade at One Angel Square, Manchester, UK [source: Alastair Wallace / Shutterstock.com]

2.2 Daylighting and indoor air quality

With the relationships noted above, there is a need to integrate thermal comfort, natural ventilation and daylighting strategies. Research has shown that typical business operating costs can be broken down into 1% energy costs, 9% rental costs and 90% staff costs (Browning, 2012). Therefore, anything that impacts the ability of employees to be productive should be a major concern for any organisation. Good lighting is critical for occupant wellbeing, which is closely connected to views of the outside world.

As highlighted in a review of best practice for “green” offices (World Green Building Council, 2015), research in 2003 identified 15 studies linking improved ventilation with up to 11% gains in productivity, because of increased outside air rates, dedicated delivery of fresh air to the workstation and reduced levels of pollutants (Loftness, Hartkopf, & Gurtekin, 2003). As the same review noted, it is a challenge to ventilate and cool offices in warm climates without a massive increase in energy use, but through innovative facade design and more energy efficient passive systems, natural ventilation must be an integral part of any solution.

2.3 Biophilic design

Linked to the above issues, there is a growing (no pun intended) scientific understanding of biophilic design, and the positive impact of green space and nature on mental health. While climbing plants such as creepers and roses have been seen growing on house walls for decades, not always intentionally and sometimes to the detriment of the structure it must be said, the green facade is an emerging trend that is quite literally taking the window box to the next level.

Bosco Verticale (Vertical Forest) is a pair of residential tower blocks in Milan, designed by Boeri Studio and completed in 2014 (Fig. 3). Here the façade has been designed to incorporate over 700 trees and numerous plants and shrubs, reckoned to be the equivalent of one hectare of typical woodland.



Fig. 3 Bosco Verticale with the UniCredit Tower behind in Milan, Italy. [Source: Konstantin Tronin / Shutterstock.com]

3 Material sustainability

Buildings must be able to demonstrate their sustainability credentials and the façade has an important role to play in this. It is important to assess the façade in a holistic sense, as part of the whole building: from design, manufacture, in use and at end-of-life. This approach is usually captured through Life Cycle Analysis (LCA). Sustainable building assessment schemes such as BREEAM, LEED and DGNB have helped in raising awareness of the issues, despite not always fully reflecting the value of metals at end-of-life. Typically, the façade represents 10-15% of the total score available to a building in a given assessment scheme. As our own skin is essential for life, so the façade of a building is also indispensable. Without a façade with up to date functionality, it is impossible for the building to meet the latest sustainability criteria. Which also means facades should be able to adapt to the changing needs of society, to remain truly sustainable. While there are many definitions for “sustainability”, in the context of the façade we include energy efficiency, and we include the ability to sense and respond to external factors and user behaviour to control light and ventilation for occupant comfort, as discussed previously. In this section, we consider material sustainability, with a focus on aluminium, i.e. how long it lasts and what happens at the end-of-life.

3.1 Durability and flexibility

Although in relative terms, aluminium is a “new” metal, with affordable volume production of aluminium invented by Charles Martin Hall and Paul Héroult in 1886, its durability credentials are well established. The Pavillon du Centenaire de l’Aluminium was designed by Jean Prouvé (1901-1984), celebrating 100 years from the first production of aluminium in France in 1854 using the method developed by Henri Étienne Sainte-Claire Deville. It was built in Paris in 1954 using an aluminium framework with aluminium panels and glass infills (see Figure 4). The building was considered a landmark in 20th century architecture and it further demonstrated the potential for aluminium to create buildings made of lightweight prefabricated structures with pure simple lines. It was first rebuilt in Lille in 1956 and subsequently renovated and rebuilt in 2001 at the Parc des Expositions, Villepinte, Paris, demonstrating not only the durability of aluminium structures, but also their inherent flexibility.



Fig. 4 Pavillon du Centenaire de l'Aluminium, designed by Jean Prouvé. [Source: Ben Fisher of Michael Stacey Architects, see (Stacey, 2014)]

In 1934, anodised aluminium windows were installed at the University of Cambridge Library; they are still in good working order today. In 1953, described by *Popular Mechanics* as ‘the world’s first aluminium skyscraper’, the Alcoa Building in Pittsburgh, Pennsylvania, USA, was clad in “unitised” pressed aluminium curtain walling. When visually inspected in 2013, this project is described as in remarkably good condition (Stacey, 2014).

As part of their interim conclusion from extensive research into the use of aluminium in the façade, Stacey et al (Stacey, 2014) noted critical factors for durability, including alloy composition, surface finish and regular cleaning: “The interim conclusion of this research suggests that well-specified and well-detailed aluminium architecture should be considered to be very durable and have a very long life expectancy... The oldest extant aluminium components of architecture in this study are now 120 years old.” We are often asked what the service life of aluminium windows is. Third parties such as the Building Research Establishment in the UK give a reference service life for aluminium windows of 40 years. Based on their findings, Stacey et al recommend that this is revised to at least 80 years based on the frame material, intermediate replacements of weather stripping and Insulating Glass Units notwithstanding.

It is worth noting that several office buildings designed and constructed in the 1970s and 80s in Europe, such as Tour First, have now been renovated. Renewal of the façade to improve energy efficiency and occupant wellbeing, while maintaining the buildings’ outer appearance, is usually an important aspect of this renovation. Replacement of outdated and inefficient IGUs with modern coated glass systems alongside computer-controlled solar shading and ventilation systems tailored to each building, for example, increases operational efficiency and improves comfort for building occupants (Hannoudi, Christensen, & Lauring, 2015) (Fotopoulou, Semprini, Cattani, Schihin, & Weyer, 2018). The flexibility of curtain walling systems facilitates such renovation and means that buildings can be improved cost-effectively and sustainably, although this should always be assessed through LCA. Another key role for FAECF is to promote this message and find ways to increase the rates of building renovation in Europe.

3.2 Circular economy

The concept of the circular economy has arisen from consideration of material flows and the need to maintain access to those materials and resources for future use. For a truly circular materials flow, there is a need to maintain, refurbish, reuse and recycle products at end-of-life, feeding the components and materials back into the lifecycle of the original product in a closed loop. With their durable nature, reusability and excellent recyclability, metals lend themselves to the circular economy.

While consideration of the circular economy has tended to focus on products such as fast-moving consumer goods and relatively short-lived electronic goods to date, policy makers are seeking to address the circular economy in construction, where the time between product manufacture and their end-of-("first")-life can be relatively long. By weight however, construction and demolition waste is the single biggest waste stream in the EU, and this must be addressed (Reike, Vermeulen, & Witjes, 2018).

In a construction context, the circular economy is focused on maximising the reusability and recycling of products and raw materials at the end of a building's life, minimising the loss of valuable materials while also fully contributing to the design. This is far removed from the linear "take-make-consume-dispose" model, in which raw materials are converted into products that are effectively lost at the end of their life cycle.

Metals are almost infinitely recyclable and while high economic value is the main driver for systematic collection and recycling of aluminium building products at end-of-life, with more than 95% of aluminium products used in buildings collected, there is considerable current interest in developing closed loop recycling schemes for aluminium building products in Europe, following the A|U|F scheme currently operating in Germany (A|U|F, n.d.). Such a closed loop scheme allows for closer control of the composition of the recycled material, with a high-quality window, door or curtain walling profile recycled into another high-quality window, door or curtain walling profile. As shown by the international organisation European Aluminium in detail for aluminium window frame recycling, recent advances in analysis and separation technologies allow for new recycling routes that can be applied in different markets.

The Dutch bank ABN AMRO supports the transition to the circular economy and is keen to set an example when it comes to its own offices. The ABN AMRO Circl Pavilion (VMRG, n.d.) (Circl, n.d.), designed by Architekten Cie in 2015 and situated in front of the ABN AMRO headquarters in Amsterdam, claims to be the first circular building design in the Netherlands and has been nominated for the Dutch Architectural Association Best Building of the Year 2018 (see Figure 5).

The project has involved a close partnership between architects, advisors, universities and suppliers of the next generation of sustainable solutions. BREEAM has been a driver for ABN AMRO. The expected energy use of the ABN AMRO Pavilion is 58 kWh per m² gross floor area (GFA) per year, with 65% of this energy coming from renewable sources. This is about half of the typical energy use for an office where around 20 people work. The expected water consumption per person per year is 5 m³, with 40% coming from rainwater or grey water. With the Pavilion, ABN AMRO hopes to set a benchmark for circular buildings of the future. The Pavilion is a 'living lab' that can continuously adapt to changes in use and its environment and test new technology.

After a wide search, ABN AMRO ultimately chose a local company for the Pavilion's solar-panels, Exasun. Exasun designs and manufactures its panels in the Netherlands, thus reducing shipping costs and environmental impact. Moreover, Exasun produces panels that have glass layers on both their top and under-sides. This makes them more sustainable than standard panels, which lose around 0.7% of their output per annum. The Exasun panels are expected to last for a minimum of 50 years. There are 260 panels installed on the roof of the Pavilion, with a further 260 fitted all along the outer edge of the building's exterior walls.

Together with TU Delft, the building's designers came up with a number of energy-efficient systems, including the Pavilion's system of horizontal and vertical geothermal heat exchangers which help to reduce 'normal' energy usage. The vertical heat exchangers comprise a series of nine boreholes, some 80 metres deep, and use geothermal energy to heat and cool the building.

PCMs – Phase Change Materials – were used throughout the floor and ceilings in the ground floor. PCMs are similar to the elements in a cool box and contain a saline solution which either solidifies or melts depending on the temperature. They essentially work like a thermal battery. When a space reaches the desired temperature – 20°C, for example – the solution melts and produces a cooling effect. When the temperature drops – when thermally cooled water from the geothermal heat exchangers is pumped over the PCMs, for example –the solution solidifies and ‘recharges’ the phase-change ‘battery’. A thermal buffer like this means the temperature in the building can be controlled with a minimum use of energy.



Fig. 5 Paviljoen ABN AMRO in Amsterdam. [Photo courtesy: De Groot & Visser.]

As well as trialling innovations such as PCMs and insulation material made from recycled jeans, the ABN AMRO Paviljoen was designed as an open and transparent structure using extensive aluminium curtain walling in the façade that ensures excellent daylight levels in the building, as well as feelings of space and connection with the outside world. It should be noted that prefabricated elements designed to be more easily dismantled and recycled are often used in the construction of buildings that are based on the principles of circularity.

The curtain walling system used makes glass infill weights of up to 700 kg possible thanks to patented thermally-broken glass supports. This combined with the ability to accept glazing units up to 60 mm wide, means that triple glazing with low U-values can be used. The maximum glass weight of 700 kg also allows larger sizes of glass to be used for maximum transparency and an optimal incidence of natural light. The U_f value is 0.81 W/m²K.

4 Digitalisation and BIM

Building Information Modelling (BIM) is a common theme of these initiatives. Of course, BIM is not a new concept. A paper in the 1980s predicted that model objects would connect to relational databases containing product data. Architects have long used software tools to design, plan and analyse buildings. While most have focused on the visual 3D aspects of modelling historically, the importance of data (the “I” of BIM) is rightly coming to the fore. BIM can be also traced to developments in the engineering world for the exchange of product data, including the Initial Graphics Exchange Specification (IGES) in the 1970s and 1980s, and ISO 10303, known informally as STEP (Standard for the

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Exchange of Product model data), in the 1990s. For the automotive and aerospace sectors, the benefits of such standards are clear and widely adopted.

Hence, there is an urgent need for recognised international standards for BIM, particularly with respect to construction product data. In 2018, two “foundation” European standards are scheduled to be published: EN ISO 19650-1 (Organization of information about construction works -- Information management using building information modelling -- Part 1: Concepts and principles) and EN ISO 19650-2 (Part 2: Delivery phase of the assets). This should be followed in 2020 by parts 3 (Operational phase of assets) and 5 (Specification for security-minded building information modelling, digital built environments and smart asset management). However, 2020 is also likely to be the earliest that any European standards for managing construction product data will be published.

There are several challenges for facade-related products with respect to product data. They are usually bespoke and built as an assembly, particularly in a commercial construction context, and their performance will depend on the design details as well as their interaction with the rest of the building. Any product data will therefore need to highlight this interdependency, and the supply chain will need to maintain and update the product data as each design develops. This is also closely linked with the “Smart CE marking” initiative. For SME fabricators and installers, this could require dedicated resource and a change in working practices.

Such a change should not be implemented by first adopting a software platform and changing business processes to suit. It has long been recognised that in any change programme, first address the “people”, then the “process” and then finally the “technology”; the required data should be the result. Step one is changing the culture. Therefore, we need to continue explaining the benefits of BIM to all decision makers and ensure that each organisation that will need to implement BIM has its own “BIM Champion” in place now.

A'DAM Toren is the new name for 'Toren Overhoeks'. This Dutch tower was designed by the architect Arthur Staal as a commission by Royal Dutch Shell. It was first officially opened in 1971 and was home to the multinational oil company until 2009. Staal designed the office tower at 45° to the river IJ waterfront. This diagonal position ('overhoeks' in Dutch) gave the building its first name. In 2017 A'DAM finished an extensive three-year renovation programme and it has been transformed into an iconic multifunctional tower (VMRG, n.d.). It is now home to a mix of offices, cafés, restaurants, a hotel, an observation point and a revolving restaurant. The plinth and the crown of the building are made using curtain walling, with many unique features, including almost 800 concrete elements utilising specially developed aluminium frames and 18 m² windows weighing 1,850 kg each.

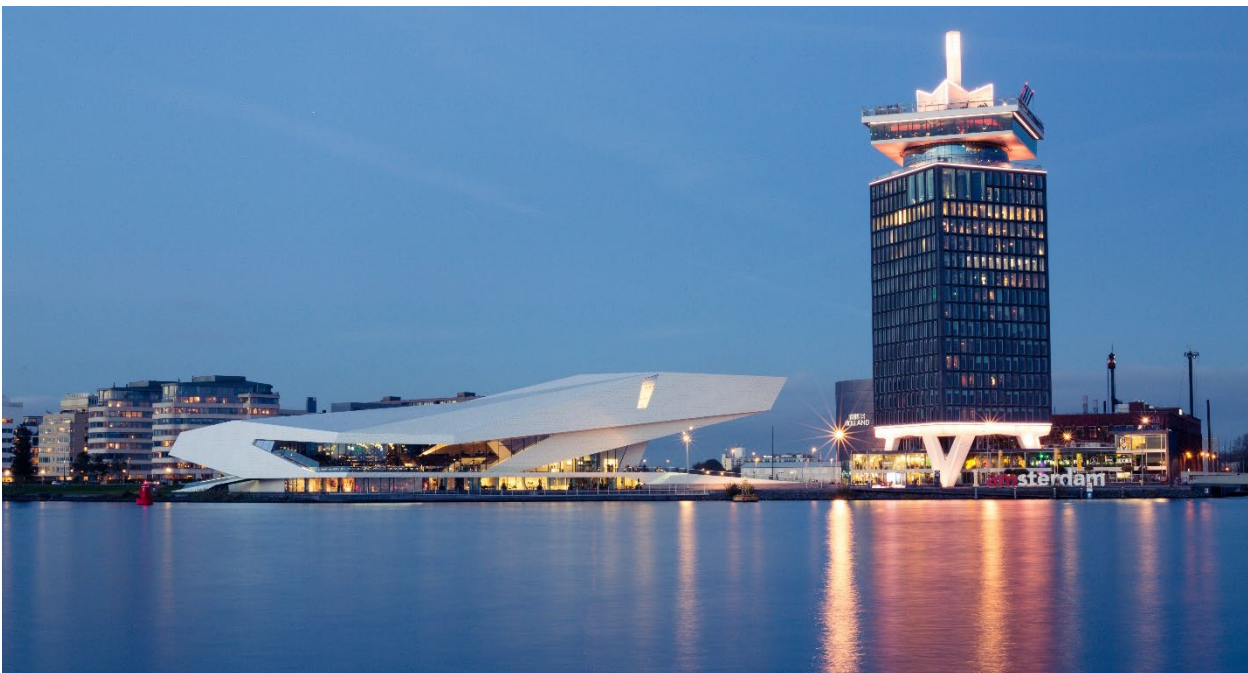


Fig. 6 A'DAM Toren, Amsterdam. [source: Evaldas Jankauskas / Shutterstock.com]

A'DAM opened in May 2016 and is seen as a catalyst for the regeneration of the Overhoeks area (see Fig. 6). BIM was used extensively in the project, which allowed offsite manufacture of the glazed elements, comprising the aluminium inner frames inserted into the concrete outer frames. This effectively halved the number of lifting movements needed on site and the construction of the façade on site took only eight weeks.

4.1 Offsite manufacture and modular construction

The current shortage of housing in parts of Europe, the digitalisation of construction and the circular economy are three of the factors helping to drive offsite manufacture and volumetric, modular construction. Arguably, for most window units and unitised curtain walling, our industry is already engaged in offsite manufacture, and to address the housing shortage in the UK in the 1940s, aluminium prefabricated housing was built using capacity from the aircraft industry factories. In total, 54,500 of these aluminium “prefabs” were manufactured. These modest detached houses proved very popular and although their planned life was only up to ten years a small number still survives. So these concepts may not be new to us.

While a car is precision engineered from modules by robots in a clean factory, we typically assemble new buildings in a muddy field (at least, this is usual in the UK). However, things will now change for the better. When the Holiday Inn Express in Manchester, UK, was recently constructed, 220 bedrooms were essentially assembled onsite in four weeks from completed modules based on shipping containers. Overall, it is reckoned by the designers Chapman Taylor that the modular build saved nearly six months from the build time, when compared with traditional methods. In terms of the value chain interactions, offsite and modular construction methods are no different from traditional methods in many respects. For example, the specialist façade contractor should be engaged from the start of the process to ensure that their expertise and input is joined up with other professions.

Unitised curtain walling could also be considered as a type of offsite manufacture, and current designs are considerably more sophisticated than early versions from 50 years ago. Increased control of quality, greater levels of airtightness and weather resistance and the need to overcome limitations with site access are some of the factors fuelling the growth in the use of unitised systems in some markets.

4.2 Developments onsite

The use of robots in the construction industry is forecast to grow considerably over the next five years. Valued at \$76.6m in 2018, the construction robot market is predicted to more than double in size to \$166m by 2023, growing at around 17% a year (MarketsandMarkets, 2018). Growth will be mainly driven by factors such as demand for enhanced productivity, quality, and safety due to growing urbanisation worldwide. Labour shortages are predicted to lead to the rise of exoskeletal robots over the next five years, with this particular market segment expected to grow the most between now and 2023. Europe is seen as a major territory for construction robots. This is attributed to the large facilities of various companies for the development and production of construction and demolition robots, increasing number of government regulations, and growing need for residential and non-residential construction projects.

While high equipment costs inhibit market growth in construction robots, factors such as the adoption of 3D printing for construction and a general rise in automation at construction sites could help to open the market. Similar growth rates are predicted for the use of drones in construction. Whether this goes beyond tasks such as imaging and surveying of construction sites, to heavy lifting, for example, remains to be seen.

5 Analysis

It is difficult in a single paper to encapsulate all the developments in facades and curtain walling throughout history, as well as look into the future, and we acknowledge that we will have missed some important aspects and that our selection of case studies is subjective. In this paper we focused our attention on Europe, and we recognise that innovation is not restricted to these shores. The timeline in Fig. 7 below includes the buildings featured in this paper. It has been observed that 1955 to 1980 was a key period in the development of aluminium curtain-walling systems in Europe and in the USA (Stacey, 2014), and certainly in Europe we continue to push the boundaries of what is possible in curtain walling design, as we respond to changes in society. As Fitch observed back in 1948 (Fitch, 1948), the external walls of buildings have always acted as selective permeable membranes, but modern scientific knowledge

and technical competence merely make possible much higher, more elegant and precise levels of performance than previously.

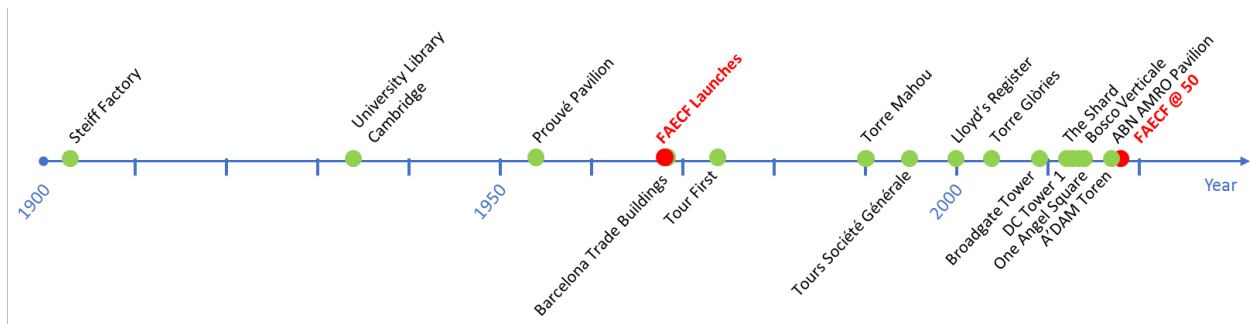


Fig. 7 Timeline highlighting the completion dates for selected landmark buildings, including those featured in this paper

6 Conclusions

Many concerns and concepts that we have focused on in this paper, are not new in the 21st century, such as double skin facades, offsite manufacture and prefabrication, it is the detailing and implementation of these techniques, and our ability to combine them with energy efficiency, occupant comfort and sustainability, with the aid of computer models, modern manufacturing techniques and improved materials, that sets the modern facade apart from those in the past. We will also expect greater control of the indoor environment, and more intelligent structures: structures that can share data and sense and adapt to the external conditions and occupant requirements. Just as a smartphone does not contain any new technology per se, as the camera, the radio, the web browser, the satnav and (yes they do come with one) the phone itself are not new inventions; it is how the technologies are combined and applied that has made the smartphone ubiquitous. It will be the same with facades, where the challenge will be to combine all the competing requirements of the external façade into one coherent solution.

While the use of data must be carefully controlled, not least to protect the privacy of the individual and to avoid sensitive data getting into the wrong hands, data will become increasingly important to the façade sector. Performance data from a building will not only be critical in optimising the performance of the façade but also in learning lessons and improving the next project. With the façade moving from a product to more of a service, the relationships in the value chain are changing, with the façade contractor increasingly becoming a long-term partner. Disciplines that were perhaps not routinely considered part of the façade contractor’s role in the 1960’s will be integral in the future: computer-aided design and manufacture including BIM; new financial and contracting models; as-built and end-user data analysis; integrated maintenance, disassembly and remanufacturing functions.

The members of the national and international Associations that are part of FAECF have successfully adapted to the changing face of the sector since 1968; with the continuing support of FAECF, our members will meet the challenges from the next 50 years.

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