

Technological development

The period from 1850 to 2000 saw many changes and developments in the field of construction and building technique.

Compared with the period before 1850, there are far more innovations in the form of products and manufacturing processes, some of them occurring in the period up to 1900 and others in the second half of the 1900s.

For example, it became much cheaper to make bricks from burnt clay. Round-the-clock ovens and the mechanised production of raw stone were introduced.

Similarly, the production of iron (steel) became more efficient with the invention of the Bessemer process and, later, the Siemens-Martin process. When simpler methods for rolling iron beams appeared, it led to an overall reduction in costs.

The introduction of the rotary kiln improved and streamlined the burning process in the manufacture of Portland cement.

The glass industry evolved by moving into the industrial manufacture of plate glass through a process of drawing; previously, a craft-based production method had been used which involved blowing the glass, cutting it and then throwing glass flasks into circular plates.

These days, plate glass is produced using the float process, whereby the molten glass is slowly cooled/annealed over large vessels of molten tin, the thickness of the glass being determined by the rate at which the molten glass is fed through: a faster rate results in thinner glass.

Our modern household utilities also started to appear around this time: firstly with the construction of waterworks, then gasworks and finally electricity stations.

(A more exhaustive description of the period up to the early decades of the 1900s can be found in *Københavnsk etageboligbyggeri. En byggeteknisk undersøgelse* from 1983, which, in spite of its geographical demarcation, generally applies to Denmark's other towns and cities as well.)

During the first half of the 1900s, the overall focus was on improving and streamlining existing products and manufacturing processes, a situation which was ably assisted by a new energy source: oil.

Following two extensive world wars, manufacturing broke with many of the traditional methods, and the resulting effects had significant implications for wider society.

The development of products and manufacturing processes also affected normal house building, albeit at a slower pace. This was especially true for multi-storey hous-

ing, and it was not until the 1930s that more significant changes started to take place. This summarised and extremely brief description of the first 100 years should naturally be seen in the light of today's building customs. Contemporaries rarely have the same perception, as can be seen from the literature of the day, which not only aimed to provide instruction on ordinary house building, but also to provide more specialised professional texts.

As the 1940s came to a close, the next couple of decades saw the start of some serious changes, not just in rapid succession but also simultaneously. In a change from the past, there was now talk of experimenting extensively with both existing and new materials and structures, as well as with the design and construction of multi-storey housing.

The speed of this process was supported in a number of different ways. First and foremost, in 1947 a separate ministry was created: the Ministry of Housing. That same year, the Danish Building Research Institute (SBI) was founded and in the following years began work on formulating a common set of building legislation for the whole country, which only passed into law in 1961 and was not initially applicable to Frederiksberg or Copenhagen.

In 1953, a circular was issued on the preference for "non-traditional construction", expressed in the requirement that the sum of masonry labour should comprise only 15% of the norm.

In the same year, the requirement for a fixed floor height of 280 cm was introduced in connection with government subsidised housing, and in 1958 the standard module rules were established, with 1M (10 cm) representing the basic module and 3M (30 cm) the planning module. These module standards were required to be used as a basis for the planning of state-assisted housing by 1964.

As a purely practical/economical measure, the company Byggeriets Maskin Stationer (BMS) was founded in 1953, quite simply to serve the construction industry with new equipment that would otherwise have been prohibitively expensive for individual companies to consider purchasing.

In 1954, a continuing education scheme arrived (and ran for four years) offering rationalisation consultants to assist construction parties with the forthcoming changes in the field of (residential) construction. In connection with the release of BR-61, yet another (two-year) continuing education initiative was set up: this was a consultancy scheme whose sole purpose was to offer training and advice on modular design.

Finally, in 1960, an economic foundation was set up in the form of a specially funded building programme comprising 7,500 homes, the first outcome of which was the launch in 1962 of the Ballerup and Gladsaxe plans comprising approximately 3,500 houses.

During the 1960s, it became clear that the changing conditions in construction involving new methods on a larger scale demanded that attention be paid to the control of time and money, and in 1968, the fixed-price-and-schedule approach was adopted for government-subsidised building (and construction) work.

Traditional building methods drew on a wealth of experience acquired over many centuries; naturally, this was not the case for the multitude of new materials, structures and collaborative methods that had been adopted since the 1950s. This led to many subsequent repairs and alterations in the decades to follow, and given the size of the individual buildings involved, financing this work was problematic.

Consequently, in 1986 a building fund was set up for government-subsidised house building, and, in order to avoid the same problems occurring in future, a quality assurance and liability reform was introduced in the same year. Similar conditions for construction carried out under the Urban Renewal Act were introduced in 1990.

(A far more thorough but easy-to-read description of this development can be found in Sven Bertelsen's book *Bellahøj, Ballerup, Brøndby Strand*, published on the occasion of SBI's 50th anniversary in 1997.)

The years leading up to the 1970s start to look so similar to "history" that many today may also regard them in the same light as the previous 100 years. But the situation after the 1960s had completely changed, and in terms of the standard multi-storey housing that is built today, the final decades of the 1900s, to a large extent, merely led to the use of larger and specially manufactured components, more mechanisation and less input from workers on the construction site.

In principle, multi-storey housing is constructed in much the same way today as it was at the start of the 1970s, though with an ever-increasing degree of compliance with growing demands for comfort and with an eye to limiting resource consumption.

But where 1960s construction was based on a standardisation of the shell, and to a certain degree of the supplemental elements and their fixtures, one could largely describe the present situation as being a return to individualised construction, without it having resulted in any real evolution.

The description of this latest development is perhaps so familiar to some that it could even seem rather simplified.